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(54) **SENSOR-ENABLED GATE VALVE**

SENSORAKTIVIERUTES SCHIEBERVENTIL

ROBINET-VANNE À ACTIVATION PAR CAPTEUR

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EP 2 809 975 B1

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Description**CROSS-REFERENCE TO RELATED APPLICATIONS**

[0001] This application claims the benefit of United States Provisional Application 61/592,321, filed on January 30, 2012, United States Provisional Application 61/643,400, filed on May 7, 2012, United States Utility Application 13/753,428, filed on January 29, 2013, and United States Utility Application 13/753,431, filed on January 29, 2013.

FIELD

[0002] The current disclosure relates to valves. Particularly, the current disclosure relates to gate valves.

BACKGROUND

[0003] Valve elements are used to regulate or control the flow of material by opening, closing, or partially obstructing various passageways. One type of valve is a gate valve, which can be used in a number of applications. US 6557 577 B1 describes a union assembly useful in a fluid flowstream includes a body portion, a pressure indicating device and a removable cover. FR 2 764 360 A1 a valve consisting of a housing defining an internal chamber connecting to the outlets of two pipes respectively inlet and outlet of the said internal chamber. DE 43 28 879 A1 describes a shut-off fitting as butterfly valve, ball valve, poppet valve, or gate valve.

SUMMARY

[0004] Disclosed is a gate valve having a body, and a sensing bore defined in the gate valve.

[0005] Also disclosed is a subassembly including a body, the body defining a sensing bore; a bonnet contacting the body; and at least one of a vein and a plug in the sensing bore.

[0006] Also disclosed is a method of sensing an aspect of a water control system, the method including gaining access to the water control system through an access bore in a gate valve; at least temporarily removing water for testing from the access bore; and sensing an aspect of the removed water.

[0007] Also disclosed is a gate valve including a body, a stem, and a sensing bore defined in the stem.

[0008] Also disclosed is a method of sensing an aspect of a water control system, the method including gaining access to the water control system through an access sensing bore defined in the a stem of a gate valve; at least temporarily removing water for testing from the access sensing bore; and sensing an aspect of the removed water.

DESCRIPTION OF THE FIGURES

[0009] The features and components of the following figures are illustrated to emphasize the general principles of the present disclosure and are not necessarily drawn to scale. Corresponding features and components throughout the figures may be designated by matching reference characters for the sake of consistency and clarity. Although dimensions may be shown in some figures, such dimensions are exemplary only and are not intended to limit the disclosure.

FIG. 1 is a perspective view of a subassembly of a body, a bonnet, and a vein in accord with one embodiment of the current disclosure.

FIG. 2 is a cross-sectional view of the subassembly of FIG. 1.

FIG. 3 is a view of the detail denoted by Detail 3 in FIG. 2.

FIG. 4 is a cross-sectional view of a subassembly of the body and the bonnet of FIG. 1 and a plug in accord with one embodiment of the current disclosure.

FIG. 5 is a view of the detail denoted by Detail 5 in FIG. 4.

FIG. 6 is a cross-sectional view of the subassembly taken along the plane denoted by line 6 in FIG. 2.

FIG. 7A is a front and partial cross-sectional view of an encapsulated disc for use with the subassembly of FIG. 1 in a gate valve.

FIG. 7B is a side view of the encapsulated disc of FIG. 7A

FIG. 7C is a top view of the encapsulated disc of FIG. 7A

FIG. 8A is a side view of a stem for use with the subassembly of FIG. 1 in a gate valve.

FIG. 8B is a top view of the stem of FIG. 8A.

FIG. 9A is a top view of a disc nut for use with the subassembly of FIG. 1 in a gate valve.

FIG. 9B is a front view of the disc nut of FIG. 9A.

FIG. 9C is a side view of the disc nut of FIG. 9A.

FIG. 10A is a top view of a disc nut for use with the subassembly of FIG. 1 in a gate valve.

FIG. 10B is a side view of the disc nut of FIG. 10A.

FIG. 10C is a bottom view of the disc nut of FIG. 10A.

FIG. 11 is a top view of a top cover for use with the subassembly of FIG. 1 in a gate valve.

FIG. 12 is a side view of a guide cap for use with the subassembly of FIG. 1 in a gate valve.

FIG. 12A a cross-sectional view of the guide cap taken in a plane indicated by line 12A in FIG. 12.

FIG. 12B a cross-sectional view of the guide cap taken in a plane indicated by line 12B in FIG. 12.

FIG. 13A is a perspective view of a gate valve in accord with one embodiment of the current disclosure including the subassembly of FIG. 1.

FIG. 13B is a perspective view of a gate valve in accord with one embodiment of the current disclosure including the subassembly of FIG. 4.

FIG. 14 is a cross-sectional view of the gate valve of FIG. 13A.

FIG. 15 is a cross-sectional view of the gate valve taken in a plane indicated by line 15 in FIG. 14.

FIG. 16 is a cross-sectional view of the gate valve of FIG. 13B.

FIG. 17 is a cross-sectional view of the gate valve taken in a plane indicated by line 17 in FIG. 16.

FIG. 18 is a cross-sectional view of a gate valve in accord with one embodiment of the current disclosure.

FIG. 19 is a detail view of the gate valve of FIG. 18.

DETAILED DESCRIPTION

[0010] Disclosed are methods, systems, and apparatus associated with sensing characteristics of fluid flow in a gate valve. A subassembly 100 of a body 110, a bonnet 120, and a vein 130 is seen in FIG. 1. The subassembly 100 is incorporated into a gate valve 1000, seen in FIG. 13A. The bonnet 120 includes a notch relief 140 into which the vein 130 fits. The body 110 defines a fluid bore 145 which is substantially continuous from an inlet end 112 to an outlet end 114 of the body 110 to allow fluid flow therein.

[0011] As seen in cross-sectional view in FIG. 2, an interior 210 of the body 110 is substantially continuous and includes the fluid bore 145 and a valve cavity 214 that is defined within the body 110. The valve cavity 214 includes a valve seat 215. An interior 220 of the bonnet 120 is defined within a cavity 225 of the bonnet 120. The cavity 225 of the bonnet 120 is in fluid communication with the valve seat 215 which is then in fluid communication with the fluid bore 145. In use, fluid flows from the inlet 112 to the outlet 114. The gate valve 1000 incorporating the subassembly 100 includes an encapsulated disc 710 (see FIGs. 7A-7C) as a selective gate to prevent fluid flow. A gasket seat 222 provides space for inclusion of a gasket (not shown) to seal the connection between the bonnet 120 and the body 110. The bonnet 120 includes a flange 255 that matches up with the body 110 over the gasket seat 222, where a flange 655 (seen in FIG. 6) matches that of the flange 255. The flange 255 allows for bolts to secure the bonnet 120 to the body 110. The flange 255 ends at an outermost extent 257. The flange 655 is readily discerned in FIG. 2 because the cross-sectional view is taken through webbing 235. Webbing 236 is seen on the body 110 one opposite side of the valve cavity 214 from webbing 235.

[0012] Also seen in FIG. 2, the notch 140 of the bonnet 120 aligns with a sensing bore 230 in the webbing 235 of the body 110. The sensing bore 230 extends from a flange end 240 of the body 110 down to the fluid bore 145. A lay length 250 as measured from the inlet end 112 to the outlet end 114 of the body 110 can also be seen.

[0013] As seen in FIG. 3, the sensing bore 230 includes an insert portion 310 and a threaded portion 320. Likewise, the vein 130 includes a shank portion 330 and a

threaded portion 340. As can be seen, the vein 130 defines a bore 350 extending from a shank end 360 of the vein 130 to a thread end 370 of the vein 130 such that the bore 350 is continuous along the entire length of the vein 130. The vein 130 is shown with its threaded portion 340 engaging the threaded portion 320 of the sensing bore 230. This interaction secures the vein 130 in place and seals an interior surface 380 of the vein 130 from an exterior surface 390. Although the vein 130 and the sensing bore 230 are cylindrical in the current embodiment, these shapes should not be considered limiting on the scope of the disclosure.

[0014] As seen, the vein 130 extends nearly the entire length of the sensing bore 230. Although some unengaged threads are shown along the threaded portion 320, the vein 130 is designed to extend as far as possible into the sensing bore 230. The vein 130 is made of brass, stainless steel, copper, plastic, or any other type of material subject to low corrosion in an aqueous environment. Typically, the body 110 and the bonnet 120 are made of cast iron, although other similar materials may be used in various embodiments. Because cast iron can be highly corrosive when exposed to water, the extension of the vein 130 into the sensing bore 230 prevents corrosion, pitting, and tuberculation from degrading the ability of fluid to flow through the sensing bore 230. Typically, the body 110 will have a protective coating, but, in some circumstances, such a protective coating may not be applied easily to the interior of the sensing bore 230. However, in some embodiments, no vein 130 will be needed to prevent corrosion because a protective coating may be applied inside the sensing bore 230. In some embodiments, the vein 130 or another vein may be used but may not need to be extended along the entire length of the sensing bore 230.

[0015] As seen in FIGs. 1-3, the sensing bore 230 is generally cylindrical although the notch 140 is not. The notch 140 includes a portion that is semi-cylindrical, but the remainder of the notch 140 extends to the outermost extent 257. This configuration of the notch 140 allows for easier assembly of the bonnet 120 onto the body 110 if the vein 130 is already in place. For example, in some embodiments, the vein 130 may be prefabricated with the body 110 or may be preassembled with the body 110 as provided. For another example, in some embodiments, the subassembly 100 may need to be serviced or the bonnet 120 may need to be replaced due to cracking or other failure. Gate valves are designed in sizes ranging from a few centimeters (a few inches) to several meters (several feet) in diameter. Particularly in embodiments with larger diameters, the bonnet 120 may be extremely heavy. Some gate valves are as large as 122 cm (48-inches) in diameter, and 60 cm (24-inch) diameter gate valves each include a bonnet weighing approximately 2,270 kg (5,000 pounds). As such, attempting to align the vein 130 with a bore in the bonnet 120 may be very difficult. The notch 140 allows a user assembling the subassembly 100 to place the bonnet 120 onto the

body 110 and then slide the bonnet 120 into place with the notch 140 aligned to the vein 130 and the sensing bore 230. However, in some embodiments-particularly in embodiments in which the bonnet 120 is relatively light-the bonnet 120 may include a bore instead of the notch 140 with an open side, as in the current embodiment.

[0016] One advantage to the placement of the sensing bore 230 and the vein 130 is that the placement does not require an increase in the lay length 250 of the body 110. Thus, the body 110 can be used with piping systems that are already designed for standard lay lengths such as lay length 250. From time to time, such gate valves will need servicing, either to remove blockages in the line, to repair cracked piping, to repair a non-functioning gate valve, or for other purposes. As such, damage to the vein 130 poses a significant risk. Another advantage to the placement of the vein 130 is that it is close to other components of the subassembly 100. As such, the vein 130 may be less-susceptible to movements in the earth whether such movements are seismic or due to assembly, disassembly, and burying of the subassembly 100 in the ground.

[0017] Another reason why it is advantageous to place the vein 130 on the subassembly 100 is that the subassembly 100 is part of the gate valve 1000. Pipes in a piping system are typically installed as quickly as possible. Gate valves such as gate valve 1000, on the other hand, are typically handled with care because improper installation of gate valves can lead to leaking piping systems and nonfunctioning gate valves. As such, there is a higher likelihood that sensors such as the pressure sensor-which may be relatively delicate and relatively expensive-are also handled with care if the vein 130 and the pressure sensor are attached to the gate valve 1000 as opposed to another component of the piping system.

[0018] As seen in the embodiments of FIGs. 4 and 5, a subassembly 100' may be substantially the same as subassembly 100. However, in some embodiments, the subassembly 100' may be provided with a plug 510 instead of the vein 130 as in subassembly 100. Such an embodiment as subassembly 100' may make the use of veins 130 optional. In such embodiments, one who assembles the piping system may optionally place the vein 130 or another device into the sensing bore 230 in place of the plug 510. The plug 510 is threaded to engage the threaded portion 320 of the sensing bore 230. As seen, the plug 510 includes a hex head 520 and operates similarly to a set screw in the current embodiment. However, in other embodiments, various configurations of plugs may be used. In some embodiments, a quick-connect adapter may be connected to the sensing bore 230 to allow quick assembly of sensing apparatus. In some embodiments, the vein 130 or a similar probe may be molded in place inside the body 110 casting. In such embodiments, threaded portions 320,340 may be unnecessary as compression from the cooling of the cast iron most likely will retain the vein 130 in place.

[0019] FIG. 6 shows the subassembly 100 on a plane

cut through the axis of the vein 130 orthogonal to the cutting plane in the view of FIG. 2. As can be seen, the flange 655 of the body 110 corresponds with the flange 255 of the bonnet 120. The thickness of the webbing 235 can be seen in the view. In various embodiments, the webbing 235 is various thicknesses. As shown, the subassembly 100 includes 15 cm (6-inch) fluid bore 145. The vein 130 is about 3.81 cm (one-half inch) in external diameter. The webbing 235 (and also 236) is about 2.5 cm (one inch) in thickness. As such, the sensing bore 230 is located centrally to retain the structural integrity of the webbing 235. In embodiments of larger size, the webbing 235 may be thicker even if the sensing bore 230 and the vein 130 are not. Thus, in larger size embodiments, placement of the sensing bore 230 is less important. In smaller size embodiments, a smaller vein 130 and sensing bore 230 may be used to accommodate thinner webbing 235.

[0020] As seen in FIGs. 7A-7C, encapsulated disc 710 can be added to subassembly 100 as part of a gate valve 1000 in accord with one embodiment of the disclosure. As seen the encapsulated disc 710 includes a contact surface 715 for contacting and sealing with the valve seat 215 (seen in FIG. 2). The encapsulated disc 710 is coated in a water-impervious material that aids in sealing the gate valve 1000 when in the closed position. The encapsulated disc 710 includes an actuation bore 725. The encapsulated disc 710 is actuated by a stem 810 which is seen in FIGs. 8A and 8B. The stem 810 includes a threaded portion 815 that interacts with the actuation bore 725. The stem 810 also includes a nut portion 820 that can be rotated by the users to actuate the encapsulated disc 710 and to open or to close the gate valve 1000 selectively. FIGs. 9A-9C show various views of a disc nut 910 that couples the stem 810 and the encapsulated disc 710. FIGs. 10A-10C show various views of a wrench nut 1010 which includes an indicator 1020a,1020b showing the direction of turning to place the gate valve 1000 in an open position. FIG. 11 shows a top cover 1110. The top cover 1110 includes an actuation bore 1120 and two connection bores 1130a,b. FIG. 12 shows a guide cap 1210. The guide cap 1210 is attached to the side of the encapsulated disc 710 to help prevent friction binding of the encapsulated disc 710 against the body 110. The guide cap 1210 is made of plastic in the current embodiment, although other similarly non-binding materials may be used in various embodiments. FIG. 12A shows a cross-sectional view of the guide cap taken in a plane indicated by line 12A in FIG. 12, and FIG. 12B shows a cross-sectional view of the guide cap taken in a plane indicated by line 12B in FIG. 12.

[0021] Seen in FIG. 13A, a gate valve 1000 may incorporate the subassembly 100 along with the encapsulated disc 710 (not shown), the stem 810 (not shown), the disc nut 910 (not shown), the wrench nut 1010, the top cover 1110, and guide caps 1210a,b (not shown). As seen in FIG. 13B, a gate valve 1000' may include subassembly 100' as well. FIGs. 14 and 15 show cutaway views of the

gate valve 1000. FIGs. 16 and 17 show cutaway views of the gate valve 1000'.

[0022] When in use, each gate valve 1000,1000' operates as its main function to allow a user selectively to prevent or to allow water flow through the fluid bore 145. Moving the encapsulated disc 710, the gate valve 1000,1000' can be sealed when the contact surface 715 is seated against the valve seat 215. Actuation of the stem 810 moves the encapsulated disc 710 out of the flow path of fluid, thereby opening the flow.

[0023] When the vein 130 is included, as in gate valve 1000, the sensing bore 230 and the bore 350 of the vein 130 provide a fluid pathway in fluid communication with the interior 210 of the body 110. Because fluid in a piping system is under pressure, fluid is forced through the fluid pathway, and pressure equalizes with the pressure inside the gate valve 1000. As such, a pressure sensor may be placed on the shank end 360 of the vein 130 to sense pressure within the piping system.

[0024] In other embodiments, other types of sensors may be connected to the vein 130 to sense other aspects of fluid in the system, including (particularly when the fluid is water) turbidity, chlorination, and acidity (pH), among others. In the current embodiment, the vein 130 allows sensors to be placed outside of the gate valve 1000, thereby providing a non-intrusive means of measuring aspects of the fluid in the piping system. However, some sensors may be placed proximate the thread end 370 of the vein 130 or, in some embodiments, may protrude inside the fluid bore 145. In particular, MEMS (microelectromechanical systems) sensors may be especially adapted for the small spaces of the bore 350.

[0025] It is common for gate valves such as gate valve 1000 to be buried 1.83 meters (six feet) or more below the surface of the earth. In some embodiments, sensors such as the pressure sensor may be read electronically and may include wires leading to the surface. In some embodiments, the wires may be connected to a remote communicator such as an RF device. In some embodiments, the RF device will correspond with a mesh network. In those embodiments, it may be possible for the mesh network to measure pressure along different points in the piping system, thereby making easier determination of where leaks, blockages, or other failures in the piping systems may occur. Gate valve 1000' may be provided as a sensor-capable gate valve, such that the vein 130 is not included with the assembly but may be added by the user.

[0026] Another embodiment of a gate valve 2000 is shown and described with reference to FIG. 18. The gate valve 2000 includes the bonnet 120, the body 110, a stem 2810, and a top cover 2110, among other parts and features. As can be seen, the actuation bore 725 extends entirely through the encapsulated disc 710. When the gate valve 2000 is in an open position, the actuation bore 725 is in fluid communication with the interior of the body 110 and with fluid passing therethrough. As such, the actuation bore 725 can be used as testing port.

[0027] With the gate valves 1000,1000' of previously described embodiments, the sensing bore 230 is located in the webbing 235. Although possible, such a configuration introduces a machining operation to the casting process of the bonnet 120. Although it is also possible to cast the sensing bore 230, such a casting may be difficult to achieve. Moreover, the sensing bore 230 may weaken the webbing of the bonnet 120 in some applications, which may not be desirable. Further, because the bonnet 120 is made of cast iron, some steps are typically taken to ensure that the sensing bore 230 does not corrode (as previously described).

[0028] To address these concerns, the gate valve 2000 of the current embodiment includes a sensing bore 2230 machined into the stem 2810. The sensing bore 2230 is in fluid communication with the actuation bore 725 such that fluid in the body 110 can be communicated up the stem 2810 by fluid pressure in the system for testing.

[0029] Referring now to FIG. 19, a detail of the interaction of the stem 2810 with the top cover 2110 can be seen. As can be seen, the sensing bore 2230 includes an axial portion 2231 and a radial portion 2232. The radial portion 2232 provides a portion of the testing port from inside the stem 2810 to outside. Adjacent the stem 2810 between the top cover 2110 and the bonnet 120 is a bushing 1910. The bushing 1910 may be made of various materials including plastic, metal, and composite, among others. In the current embodiment, the bushing 1910 is annular, and many of the features as shown are annular as well.

[0030] The bushing 1910 of the current embodiment includes three annular gasket seating grooves 1912,1914,1916 into which gaskets 1932,1934,1936 seat to seal the testing port from leakage. The stem 2810 includes three annular gasket seating grooves 1913,1915,1917 that provide a sealing interface with gaskets 1933,1935,1937. In other embodiments, fewer or more gasket seating grooves may be included depending on sealing requirements. The number and configuration of gaskets and gasket seating grooves may change from one embodiment to another, as will be understood by one of skill in the art.

[0031] The radial portion 2232 communicates with an external shaft annulus 1920, which is an annulus groove defined in the stem 2810. The external shaft annulus 1920 ensures that a line of fluid communication may be made regardless of the orientation of the stem 2810 with respect to the bushing 1910. The bushing 1910 includes two radial bores 1925,1927 that connect in fluid communication to the external shaft annulus 1920. The radial bores 1925,1927 are in fluid communication with an external bushing annulus 1930 which is similar to the external shaft annulus 1920 and substantially connects the two radial bores 1925,1927 along the outside of the bushing 1910.

[0032] As seen, the external bushing annulus 1930 communicates with an adapter bore 1940 in the top cover 2110. The adapter bore 1940 includes a neck portion

1942 and a threaded portion 1944 in the current embodiment, although the adapter bore 1940 need not include any specific connection configuration in all embodiments.

[0033] In the current embodiment, a sensing mechanism (not shown) may be connected to the adapter bore 1940 and in fluid communication with the interior of the gate valve 2000. As disclosed with respect to prior embodiments, the gate valve 2000 may include a plug (not shown) connected in the adapter bore 1940 if the testing port is not in use. For ease of reference, use of the testing port of the current embodiment includes the actuation bore 725, the sensing bore 2230, external shaft annulus 1920, the two radial bores 1925, 1927, external bushing annulus 1930, and the adapter bore 1940. The gate valve 2000 may include the sensing mechanism connected in the adapter bore 1940. The gate valve 2000 may include a vein such as vein 130 of prior embodiments to connect to a sensing mechanism.

[0034] Locating the sensing bore 2230 in the stem 2810 addresses many of the concerns noted with respect to prior embodiments. Because the sensing bore 2230 is not defined in the bonnet 120, it does not require a machining operation in addition to casting. Moreover, the bonnet 120 is not weakened by the inclusion of sensing bore 230, which may be a concern in some embodiments. Further, because the stem 2810 is exposed to water throughout its life, it is typically made of a material that is substantially corrosion-resistant or subjected to a process to discourage corrosion. As such, no additional steps are required to protect the sensing bore 2230 from corrosion as would be required in prior embodiments. Further, the stem 2810 may be machined in some embodiments, and adding a machining step to include the sensing bore 2230 would not introduce excessive costs for additional machinery or capital into the process of manufacturing the stem 2810.

[0035] In operation, the gate valve 2000 is normally in an open position with the gate 710 raised (not shown in FIGs. 18 and 19). When the gate 710 is lifted, the actuation bore 725 is in fluid communication with the interior of the gate valve 2000, and, as such, is exposed to fluid pressure in the piping system. The fluid pressure in the piping system allows fluid flow into the axial portion 2231 of the sensing bore 2230 and then into the radial portion 2232. Fluid exits the radial portion 2232 and travels into the external shaft annulus 1920, into the two radial bores 1925, 1927, into the external bushing annulus 1930, into the neck portion 1942 of the adapter bore 1940, and then into the threaded portion 1944 of the adapter bore 1940. The fluid in the threaded portion 1944 is then communicated into the sensing mechanism which may be capable of sensing various aspects of the fluid system, including pressure, turbidity, chlorination, and acidity (pH), among others.

[0036] In some conditions, the gate valve 2000 may be changed to a closed position. When the gate valve 2000 is in the closed position, the actuation bore 725 is not in fluid communication with the interior of the gate

valve 2000. However, the gate valve 2000 should be in the closed position only when maintenance or faults are determined in the piping system, and, as such, use of the sensing mechanism may not be required when the gate valve 2000 is in the closed position. In other embodiments, the gate 710 may include a sensing bore (not shown) to communicate fluid from one side of the gate 710 into the actuation bore 725 and maintain the ability to test at least one part of the piping system when the gate valve 2000 is in the closed position.

[0037] It should be emphasized that the embodiments described herein are merely possible examples of implementations, merely set forth for a clear understanding of the principles of the present disclosure. Many variations and modifications may be made to the described embodiment(s) without departing substantially from the present disclosure which is only defined by the appended claims.

[0038] One should note that conditional language, such as, among others, "can," "could," "might," or "may," unless specifically stated otherwise, or otherwise understood within the context as used, is generally intended to convey that certain embodiments include, while alternative embodiments do not include, certain features, elements and/or steps. Thus, such conditional language is not generally intended to imply that features, elements and/or steps are in any way required for one or more particular embodiments or that one or more particular embodiments necessarily include logic for deciding, with or without user input or prompting, whether these features, elements and/or steps are included or are to be performed in any particular embodiment.

[0039] Various implementations described in the present disclosure may include additional systems, methods, features, and advantages, which may not necessarily be expressly disclosed herein but will be apparent to one of ordinary skill in the art upon examination of the following detailed description and accompanying drawings. It is intended that all such systems, methods, features, and advantages be included within the present disclosure and protected by the accompanying claims.

Claims

1. A gate valve comprising:

a body (110); and
a sensing bore (230) defined in the gate valve, a bonnet (120), wherein a notch relief (140) is defined in the bonnet (120), and wherein the sensing bore (230) is accessible through the notch relief (120) of the bonnet (120);

a vein (130), wherein a diameter of the vein (130) is about equal to a diameter of the sensing bore (230), wherein the sensing bore (230) includes threading and wherein the vein (130) includes threading to mate with the threading of the sensing bore (230);

and

wherein the vein (130) extends through the bonnet (120) **characterized in that** the sensing bore (230) is defined centrally in a webbing (235) of the body (110), wherein the bonnet (120) includes a flange (255) with an outmost extent (257), and therein the body (110) includes a flange (655) that matches up with the flange (255) of the bonnet (120) over a gasket seat (222), and wherein the notch (140) extends to the outmost extent (257) of the flange (255).

2. A subassembly comprising:

a body (110), the body (110) defining a sensing bore (230);
a bonnet (120) contacting the body (120); and

at least one of a vein (130) and a plug (510) in the sensing bore, wherein a notch relief (140) is defined in the bonnet (130), and wherein the sensing bore (230) is accessible through the notch relief (140) of the bonnet (130), **characterized in that** the sensing bore (230) is defined centrally in a webbing (235) of the body (110), and wherein the bonnet (120) includes a flange (255) with an outmost extent (257) and the body (110) includes a flange (655) that matches up with the flange (255) of the bonnet (120) over a gasket seat (222), and wherein the notch (140) extends to the outmost extent (257) of the flange (255).

3. The subassembly of claim 2, wherein the vein (130) extends through the notch relief (140) in the bonnet (120).

4. A method of sensing an aspect of a water control system, the method comprising:

gaining access to the water control system through an access bore in a gate valve (1000, 1000');
at least temporarily removing water for testing from the access bore; and
sensing an aspect of the removed water, wherein gaining access to the water control system comprises accessing the access bore through a notch relief (140) that is defined in a bonnet (120) of the gate valve (1000, 1000'), and wherein the sensing bore (230) is defined centrally in a webbing (235) of the body (110), and wherein the bonnet (120) includes a flange (255) with an outmost extent (257) and the body (110) includes a flange (655) that matches up with the flange (255) of the bonnet (120) over a gasket seat (222), and wherein the notch (140) extends to the outmost extent (257) of the flange (255).

5. The method of claim 4, wherein gaining access to

the water control system through an access bore in the gate valve (1000) includes gaining access to the water control system through a vein (130) extending through the access bore.

6. A gate valve comprising:

a body (110);
a stem (2810);
a sensing bore (2230) defined in the stem (2810);
a top cover (2110), wherein the top cover (2110) defines an adapter bore (1940), and wherein the adapter bore (1940) is in fluid communication with the sensing bore (2230) of the stem (2810); and
a bushing (1910) positioned between the stem (2810) and the top cover (2110), the bushing (1910) defining at least one radial bore (1925, 1927) and an external bushing annulus (1930), wherein the sensing bore (2230) includes an axial portion (2231) and a radial portion (2232), the stem (2810) further defines an external shaft annulus (1920), the external bushing annulus (1930), the external shaft annulus (1920), the sensing bore (2230), and the adapter bore (1940) being in fluid communication with each other,

wherein the gate valve (2000) further comprises a gate (710), the gate (710) defining an actuation bore (725), the stem (2810) interacting with the actuation bore (725), wherein the actuation bore (725) is in fluid communication with the sensing bore (2230), and

wherein the bushing (1910) includes at least two annular gasket seating grooves (1912, 1914, 1916) into which gaskets (1932, 1934, 1936) seat to seal a testing port from leakage, and wherein the stem (2810) includes at least two annular gasket seating grooves (1913, 1915, 1917) that provide a sealing interface with gaskets (1933, 1935, 1937), and wherein the stem (2810) defines a shaft annulus such (1920) that the sensing bore (2230), the shaft annulus (1920), the radial bore (1925, 1927), the bushing annulus (1930), and the adapter bore (1940) define a flow path such that a line of fluid communication may be made regardless of the orientation of the stem (2810) with respect to the bushing (1910).

7. A method of sensing an aspect of a water control system, the method comprising:

gaining access to the water control system through a sensing bore (2230) defined in a stem (2810) of a gate valve;
at least temporarily removing water for testing from the sensing bore (2230); and sensing an

aspect of the removed water, wherein at least temporarily removing water for testing from the sensing bore (2230) includes removing water through an adapter bore (1940) defined in the top cover (2110) of the gate valve, wherein a bushing (1910) positioned between the stem (2810) and the top cover (2110), the bushing (1910) defining at least one radial bore (1925,1927) and a bushing annulus (1930), wherein the sensing bore (2230) includes an axial portion (2231) and a radial portion (2232), the stem (2810) further defines an external shaft annulus (1920) and wherein the bushing (1910) defines an external bushing annulus (1930), the external bushing annulus (1930), the external shaft annulus (1920), the sensing bore (2230), and the adapter bore (1940) being in fluid communication with each other, wherein gaining access to the water control system through the sensing bore includes gaining access to the water control system through an actuation bore of a gate, the actuation bore interacting with the sensing bore, wherein the bushing (1910) includes at least two annular gasket seating grooves (1912,1914,1916) into which gaskets (1932,1934,1936) seat to seal the testing port from leakage, and wherein the stem (2810) includes at least two annular gasket seating grooves (1913,1915,1917) that provide a sealing interface with gaskets (1933,1935,1937), and wherein the stem (2810) defines a shaft annulus such (1920) that the sensing bore (2230), the shaft annulus (1920), the radial bore (1925,1927), the bushing annulus (1930), and the adapter bore (1940) define a flow path such that a line of fluid communication may be made regardless of the orientation of the stem (2810) with respect to the bushing (1910).

8. The method of claim 7, wherein the sensed aspect includes at least one of pressure, turbidity, chlorination, and acidity.

Patentansprüche

1. Ein Schieberventil, das die folgenden Merkmale aufweist:

einen Ventilkörper (110); und
eine Fühlbohrung (230), die in dem Schieberventil ausgebildet ist, eine Haube (120), wobei eine Entlastungskerbe (140) in der Haube (120) ausgebildet ist, und wobei die Fühlbohrung (230) durch die Entlastungskerbe (120) der Haube (120) hindurch erreichbar ist;

ein Venenröhrchen (130), wobei ein Durchmesser

des Venenröhrchens (130) ungefähr gleich einem Durchmesser der Fühlbohrung (230) ist, wobei die Fühlbohrung (230) Gewinde aufweist und wobei das Venenröhrchen (130) Gewinde aufweist, das mit dem Gewinde der Fühlbohrung (230) zusammenpasst; und

wobei das Venenröhrchen (130) sich durch die Haube (120) erstreckt, **gekennzeichnet dadurch, dass** die Fühlbohrung (230) zentral in einem Netzwerk (235) des Ventilkörpers (110) ausgebildet ist, wobei die Haube (120) einen Flansch (255) mit einem äußersten Umfang (257) enthält, und worin der Ventilkörper (110) einen Flansch (655) enthält, der mit dem Flansch (255) der Haube (120) über einen Dichtungssitz (222) zusammenpasst, und wobei die Kerbe (140) sich bis zu dem äußersten Umfang (257) des Flansches (255) erstreckt.

2. Eine Unteranordnung, die die folgenden Merkmale aufweist:

Einen Körper (110), wobei der Körper (110) eine Fühlbohrung (230) ausbildet;
eine Haube (120), die den Körper (120) berührt; und

wenigstens eines von einem Venenröhrchen (130) und einem Stöpsel (510) in der Fühlbohrung, wobei eine Entlastungskerbe (140) in der Haube (130) ausgebildet ist, und wobei die Fühlbohrung (230) durch die Entlastungskerbe (140) der Haube (130) erreichbar ist, **gekennzeichnet dadurch, dass** die Fühlbohrung (230) zentral in einem Netzwerk (235) des Körpers (110) ausgebildet ist,

und wobei die Haube (120) einen Flansch (255) mit einem äußersten Umfang (257) enthält, und wobei der Körper (110) einen Flansch (655) enthält, der mit dem Flansch (255) der Haube (120) über einen Dichtungssitz (222) zusammenpasst, und wobei die Kerbe (140) sich zu dem äußersten Umfang (257) des Flansches (255) erstreckt.

3. Die Unteranordnung von Anspruch 2, wobei sich das Venenröhrchen (130) durch die Entlastungskerbe (140) in der Haube (120) erstreckt.

4. Ein Verfahren zum Erfassen eines Aspekts eines Wasserkontrollsystems, wobei das Verfahren aufweist:

Verschaffung eines Zugangs zu dem Wasserkontrollsystem durch eine Zugangsbohrung in einem Schieberventil (1000, 1000'); und
zumindest zeitweise Entfernung von Wasser aus der Zugangsbohrung zum Testen; und
Erfassung eines Aspekts des entfernten Wassers, wobei die Verschaffung des Zugangs zu dem

Wasserkontrollsystem ein Erreichen der Zugangsbohrung durch eine Entlastungskerbe (140), die in einer Haube (120) des Schieberventils (1000, 1000') ausgebildet ist, umfasst, und wobei die Fühlbohrung (230) zentral in einem Netzwerk (235) des Körpers (110) ausgebildet ist, und wobei die Haube (120) einen Flansch (255) mit einem äußersten Umfang (257) aufweist, und wobei der Körper (110) einen Flansch (655) aufweist, der mit dem Flansch (255) der Haube (120) über einen Dichtungssitz (222) zusammenpasst, und wobei die Kerbe (140) sich zu dem äußersten Umfang (257) des Flansches (255) erstreckt.

5. Das Verfahren nach Anspruch 4, wobei das Erlangen von Zugang zu dem Wasserkontrollsystem durch die Zugangsbohrung in dem Schieberventil (1000) ein Erlangen eines Zugangs zu dem Wasserkontrollsystem durch ein Venenröhrchen (130) aufweist, das sich durch die Zugangsbohrung erstreckt.

6. Ein Schieberventil, das aufweist:

einen Körper (110);
 einen Schaft (2810);
 eine Fühlbohrung (2230), die in dem Schaft (2810) ausgebildet ist;
 eine obere Abdeckung (2110), wobei die obere Abdeckung (2110) eine Adapterbohrung (1940) ausbildet, und wobei die Adapterbohrung (1940) in fluider Kommunikation mit der Fühlbohrung (2230) des Schafts (2810) ist; und
 eine Buchse (1910), die zwischen dem Schaft (2810) und der oberen Abdeckung (2110) angeordnet ist, wobei die Buchse (1910) wenigstens eine radiale Bohrung (1925, 1927) ausbildet, und einen äußeren Buchsenring (1930), wobei die Fühlbohrung (2230) einen axialen Bereich (2231) und einen radialen Bereich (2232) enthält, wobei der Schaft (2810) weiterhin einen äußeren Schaftring (1920) ausbildet, wobei der äußere Buchsenring (1930), der äußere Schaftring (1920), die Fühlbohrung (2230) und die Adapterbohrung (1940) in fluider Kommunikation miteinander sind,

wobei das Schieberventil (2000) weiterhin ein Schiebtor (710) aufweist, wobei das Schiebtor (710) eine Betätigungsbohrung (725) ausbildet, wobei der Schaft (2810) mit der Betätigungsbohrung (725) zusammenwirkt, wobei die Betätigungsbohrung (725) in fluider Kommunikation mit der Fühlbohrung (2230) ist, und wobei die Buchse (1910) mindestens zwei ringförmige Dichtungssitznuten (1912, 1914, 1916) enthält, in denen Dichtungen (1932, 1934, 1936) sitzen, um einen Testzugang gegen Undichtigkeit abzudichten, und wobei der Schaft (2810) mindestens

zwei Dichtungssitznuten (1913, 1915, 1917) enthält, die einen Dichtungsschnittstelle zu den Dichtungen (1933, 1935, 1937) bereitstellen, und wobei der Schaft (2810) einen Schaftring (1920) ausbildet, so dass die Fühlbohrung (2230), der Schaftring (1920), die radiale Bohrung (1925, 1927), der Buchsenring (1930) und die Adapterbohrung (1940) einen Durchflussweg ausbilden, so dass eine Verbindungslinie fluider Kommunikation gebildet werden kann, und zwar unabhängig von der Orientierung des Schafts (2810) in Bezug auf die Buchse (1910).

7. Ein Verfahren zum Erfassen eines Aspekts eines Wasserkontrollsystems, wobei das Verfahren aufweist:

Verschaffen eines Zugangs zu dem Wasserkontrollsystem durch eine Fühlbohrung (2230), die in einem Schaft (2810) eines Schieberventils ausgebildet ist;

zumindest zeitweises Entfernen von Wasser aus der Fühlbohrung (2230) zum Testen; und Erfassen eines Aspekts des entfernten Wassers, wobei das zumindest zeitweise Entfernen des Wassers aus der Fühlbohrung (2230) zum Testen das Entfernen von Wasser durch eine Adapterbohrung (1940) beinhaltet, die in der oberen Abdeckung (2110) des Schieberventils ausgebildet ist,

wobei eine Buchse (1910) zwischen dem Schaft (2810) und der oberen Abdeckung (2110) positioniert ist, wobei die Buchse (1910) zumindest eine radiale Bohrung (1925, 1927) und einen Buchsenring (1930) ausbildet, wobei die Fühlbohrung (2230) einen axialen Bereich (2231) und einen radialen Bereich (2232) enthält, wobei der Schaft (2810) weiterhin einen äußeren Schaftring (1920) ausbildet und wobei die Buchse (1910) einen äußeren Buchsenring (1930) ausbildet, wobei der äußere Buchsenring (1930), der äußere Schaftring (1920), die Fühlbohrung (2230) und die Adapterbohrung (1940) untereinander in fluider Kommunikation sind, wobei das Verschaffen von Zugang zu dem Wasserkontrollsystem durch die Fühlbohrung ein Verschaffen eines Zugangs zu dem Wasserkontrollsystem durch eine Betätigungsbohrung eines Schiebetors beinhaltet, wobei die Betätigungsbohrung mit der Fühlbohrung wechselwirkt und wobei die Buchse (1910) mindestens zwei ringförmige Dichtungssitznuten (1912, 1914, 1916) enthält, in denen Dichtungen (1932, 1934, 1936) sitzen, um die Testöffnung gegen Undichtigkeit abzudichten, und wobei der Schaft (2810) zumindest zwei ringförmige Dichtungssitznuten (1913, 1915, 1917) enthält, die eine Dichtungsschnittstelle mit Dichtungen (1933, 1935, 1937) bereitstellen, und wobei der Schaft

(2810) einen Schafttring (1920) ausbildet, so dass die Fühlbohrung (1930), der Schafttring (1920), die radiale Bohrung (1925, 1927), der Dichtring (1930) und die Adapterbohrung (1940) einen Durchflussweg definieren, so dass eine Linie fluider Kommunikation gebildet werden kann, und zwar unabhängig von der Orientierung des Schafts (2810) in Bezug auf die Buchse (1910).

8. Das Verfahren nach Anspruch 7, wobei der erfasste Aspekt zumindest eines von Druck, Turbulenz, Chlorierung und Säuregrad enthält.

Revendications

1. Un robinet-vanne comprenant :

un corps (110); et
un alésage de sensation (230) défini dans le robinet-vanne,

un chapeau (120), dans lequel une encoche de soulagement (140) est définie dans le chapeau (120), et dans lequel l'alésage de sensation (230) est accessible par l'encoche de soulagement (120) du chapeau (120);

une canule (130), dans laquelle le diamètre est essentiellement égal à un diamètre de l'alésage de sensation (230), dans lequel l'alésage de sensation (230) comprend un filetage, la canule (130) comprend un filetage pour correspondre avec le filetage de l'alésage de sensation (230), et dans lequel la canule (130) s'étend à travers du chapeau (120), **caractérisé en ce que** l'alésage de sensation (230) est définie centralement dans un treillis (235) du corps (110), dans lequel le chapeau (120) comprend une bride (255) avec une périphérie ultérieure (257), et dans laquelle le corps (110) comprend une bride (655) qui correspond à la bride (255) du chapeau (120) à travers un siège de joint d'étanchéité (222), et dans lequel l'encoche s'étend à la périphérie ultérieure (257) de la bride (255).

2. Un sous-ensemble comprenant:

un corps (110), le corps (110) définissant un alésage de sensation (230),
un chapeau (120) contactant le corps (120); et
au moins un de une canule (130) et un bouchon (510) dans l'alésage de sensation, dans lequel une encoche de soulagement (140) est définie dans le chapeau (130), et dans lequel l'alésage de sensation (230) est accessible par l'encoche de soulagement (140) du chapeau (130),

caractérisé en ce que

l'alésage de sensation (230) est défini centralement dans un treillis (235) du corps (110),
et dans lequel le chapeau (120) comprend une bride (255) avec une périphérie ultérieure (257), et le corps (110) comprend une bride (655) qui correspond à la bride (255) du chapeau (120) à travers un siège de joint d'étanchéité (222), et dans lequel l'encoche (140) s'étend à la périphérie ultérieure (257) de la bride (255).

3. Le sous-ensemble de la revendication 2, dans lequel la canule (130) s'étend à travers l'encoche de soulagement (140) dans le chapeau (120).

4. Un procédé pour détecter un aspect d'un système de contrôle de l'eau, le procédé comprenant:

accéder au système de contrôle de l'eau par un alésage d'accès dans un robinet-vanne (1000, 1000');
au moins temporairement puiser de l'eau de l'alésage d'accès pour capter; et

capter un aspect de l'eau puisé, dans lequel l'accéder au système du contrôle de l'eau comprends accéder l'alésage d'accès à travers une encoche de soulagement (140) qui est définie dans un chapeau (120) du robinet-vanne (1000, 1000'), et dans lequel l'alésage de sensation (230) est défini centralement dans le treillis (235) du corps (110), et dans lequel le bonnet (120) comprend une bride (255) avec une périphérie ultérieure (257) et le corps (110) comprend une bride (655) qui correspond à la bride (255) du chapeau (120) à travers un siège de joint d'étanchéité, et dans lequel l'encoche (140) s'étend à la périphérie ultérieure (257) de la bride (255).

5. Le procédé selon revendication 4, dans lequel accéder au système de contrôle de l'eau à travers d'un alésage d'accès dans le robinet-vanne comprend accéder au système de contrôle de l'eau au travers d'une canule (130) qui s'étend à travers l'alésage d'accès.

6. Un robinet-vanne comprenant:

un corps (110);
une tige (2810);
un alésage de sensation (2230) défini dans la tige (2810);
un capot supérieur (2110), dans lequel le capot supérieur (2110) définit un alésage d'adaptation (1940), et dans lequel l'alésage d'adaptation (1940) est en communication fluide avec l'alésage de sensation (2230) de la tige (2810); et
une douille (1910) positionnée entre la tige

(2810) et le capot supérieur (2110), la douille (1910) définissant au moins un alésage radiale (1925, 1927) et un anneau de douille extérieur (1930),

dans lequel l'alésage de sensation (2230) comprend une portion axiale (2231) et une portion radiale (2232), la tige (2810) en outre définissant un anneau de tige extérieur (1920), l'anneau de douille extérieur (1930), l'anneau de tige extérieur (1920), l'alésage de sensation (2230) et l'alésage d'adaptation (1940) étant en communication fluide entre eux, dans lequel le robinet-vanne (2000) comprend en plus une porte (710), la porte (710) définissant un alésage d'actuation (725), la tige (2810) interagissant avec l'alésage d'actuation (725), dans lequel l'alésage d'actuation (725) est en communication fluide avec l'alésage de sensation (2230), et dans lequel la douille (1910) comprend au moins deux rainures de siège de joint d'étanchéité annulaires (1912, 1914, 1916) dans lesquelles des joints d'étanchéité (1932, 1934, 1936) sont placés pour étancher un port de test contre fuite, et dans lequel la tige (2810) comprend au moins deux rainures de siège de joints d'étanchéité annulaires (1913, 1915, 1917) qui offrent une interface d'étanchéité avec des joint d'étanchéité (1933, 1935, 1937), et dans lequel la tige (2810) définit un anneau de tige (1920) de sorte que l'alésage de sensation (2230), l'anneau de tige (1920), l'alésage radial (1925, 1927), l'anneau de douille (1930) et l'alésage d'adaptation (1940) définissent un trajet de courant de sorte qu'une ligne de communication fluide peut être établie quel que soit l'orientation de la tige (2810) par rapport à la douille (1910).

7. Un procédé pour détecter un aspect d'un système de contrôle de l'eau, le procédé comprenant :

accéder au système de contrôle de l'eau à travers un alésage de sensation (2230) défini dans une tige (2810) d'un robinet-vanne; puiser, au moins temporairement, de l'eau de l'alésage de sensation (2230) pour capter; et capter un aspect de l'eau puisé, dans lequel l'au moins temporairement puisage de l'eau de l'alésage de sensation (2230) pour capter comprend puiser de l'eau par un alésage d'adaptation (1940) défini dans le capot supérieur (2110) du robinet-vanne, dans lequel une douille (1910) est positionnée entre la tige (2810) et le capot supérieur (2110), la douille (1910) définissant au moins un alésage radial (1925, 1927) et un anneau de douille (1930), et dans lequel l'alésage de sensation (2230) comprend une portion axiale (2231) et une portion radiale (2232), la tige (2810) définissant en outre un anneau de tige extérieur (1920), et la douille (1910) un anneau de douille extérieur (1930), l'anneau de

douille extérieur (1930), l'anneau de tige extérieur (1920), l'alésage de sensation (2230) et l'alésage d'adaptation (1940) étant en communication fluide entre eux, dans lequel accéder au système de contrôle de l'eau à travers l'alésage de sensation comprend accéder le système de contrôle de l'eau à travers un alésage d'actuation d'une porte, l'alésage d'actuation interagissant avec l'alésage de sensation, dans lequel la douille (1910) comprend au moins deux rainures de siège de joint d'étanchéité annulaires (1912, 1914, 1916) dans lesquelles des joints d'étanchéité (1932, 1934, 1936) sont placés pour étancher la porte de test contre fuite, et dans lequel la tige (2810) comprend au moins deux rainures de siège de joint d'étanchéité (1913, 1915, 1917) qui offrent une interface d'étanchéité avec des joints d'étanchéité (1933, 1935, 1937), et dans lequel la tige (2810) définit un anneau de tige (1920) de sorte que l'alésage de sensation (2230), l'anneau de tige (1920), l'alésage radial (1925, 1927), l'anneau de douille (1930) et l'alésage d'adaptation (1940) définissent un trajet de courant de sorte qu'une ligne de communication fluide peut être établie quel que soit l'orientation de la tige (2810) par rapport à la douille (1910).

8. Le procédé de revendication 7, dans lequel l'aspect capté comprend au moins un de pression, turbulence, chloration et acidité.

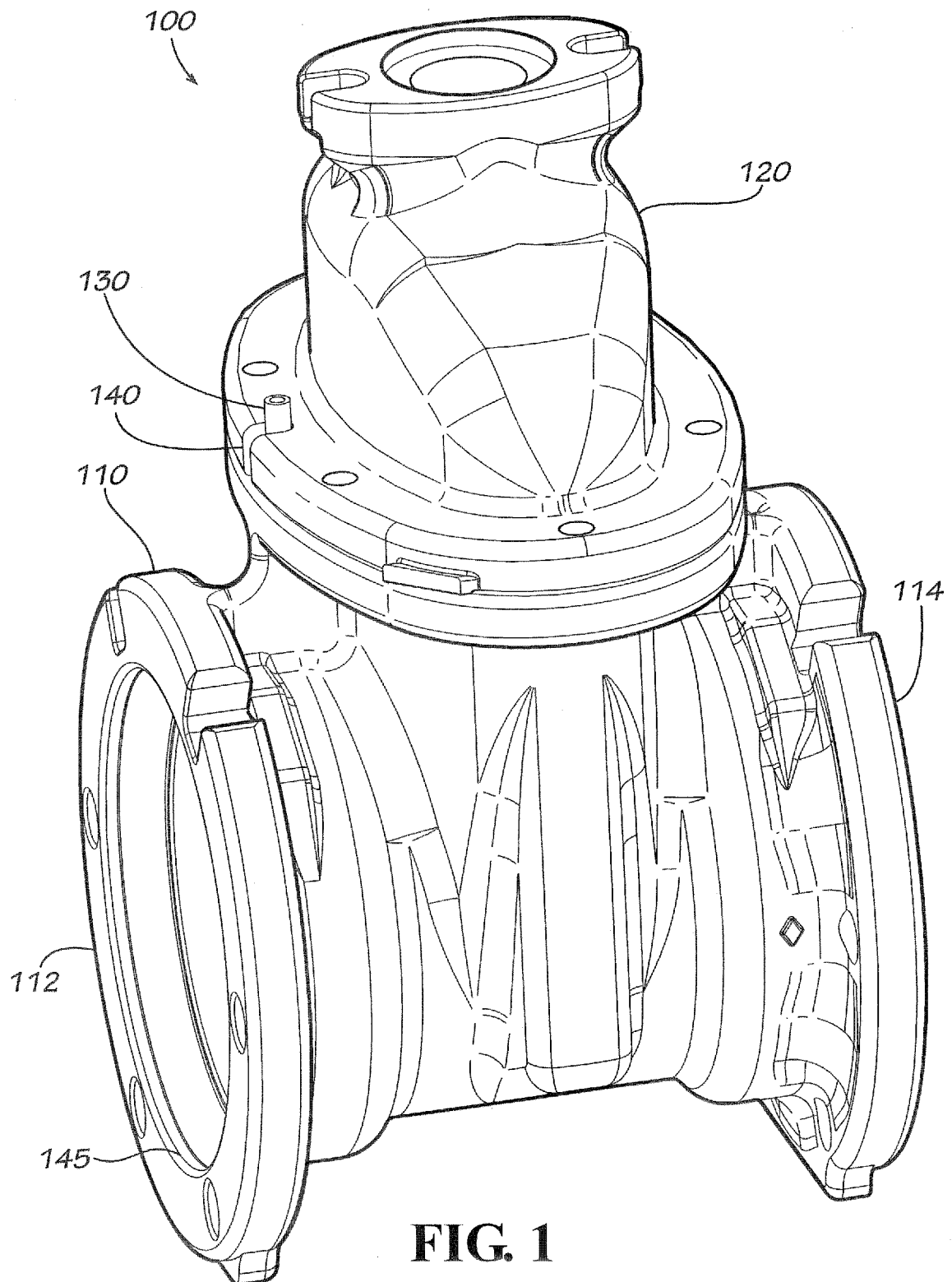


FIG. 1

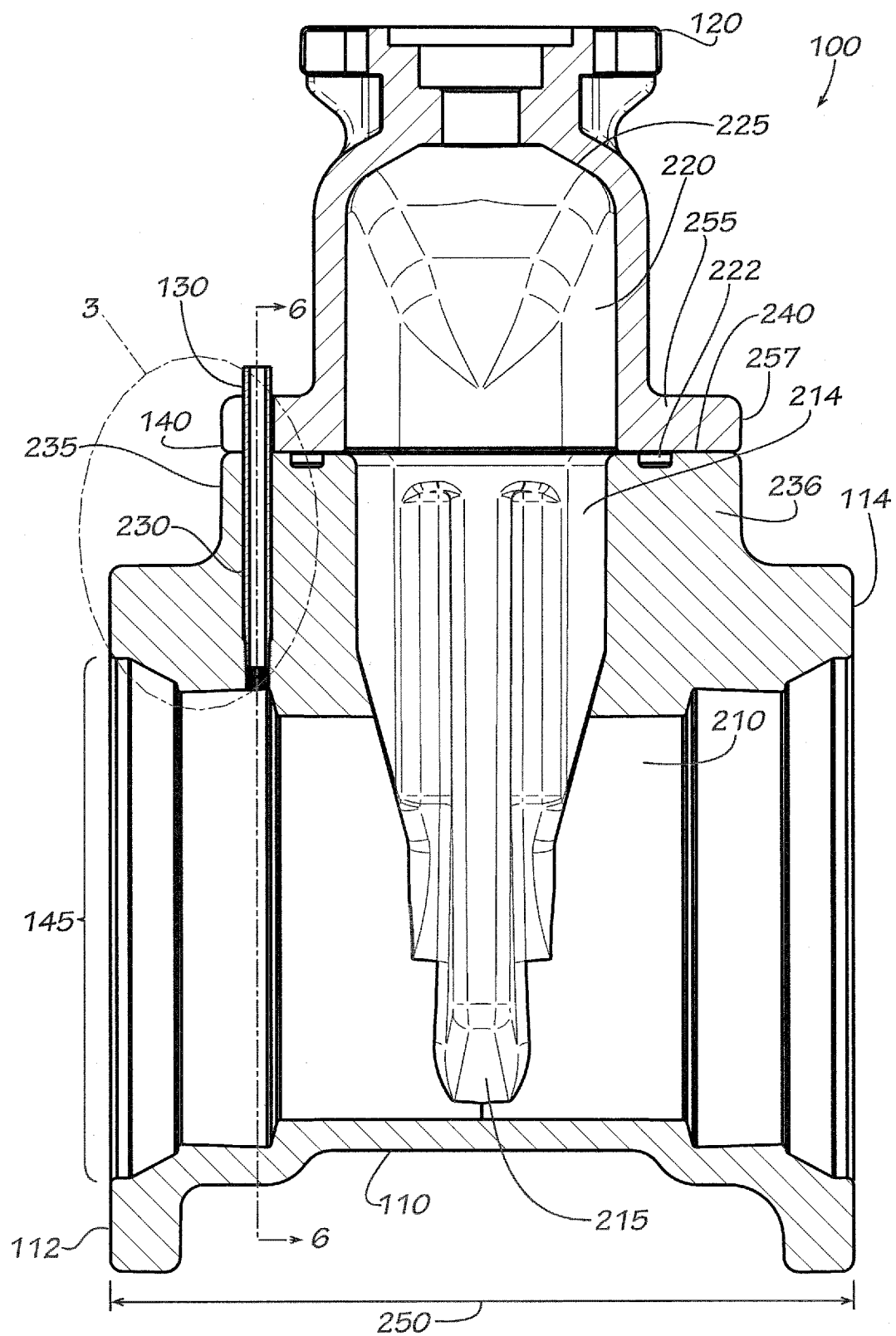


FIG. 2

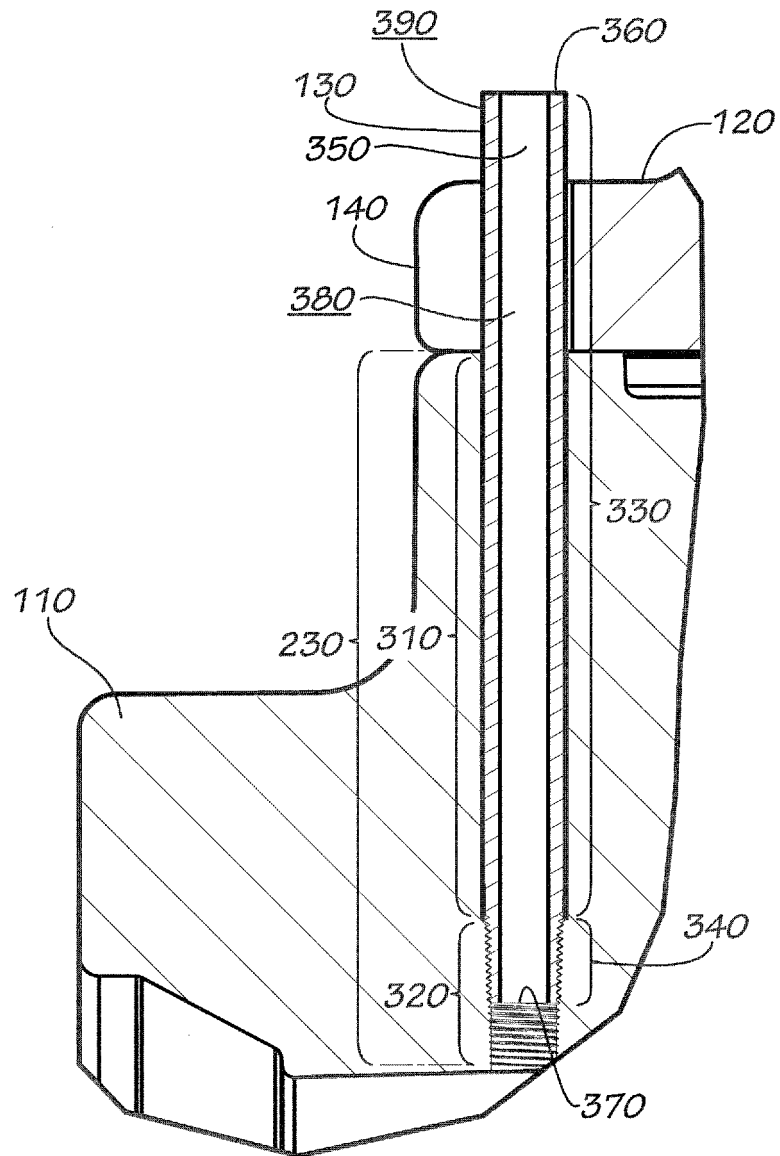


FIG. 3

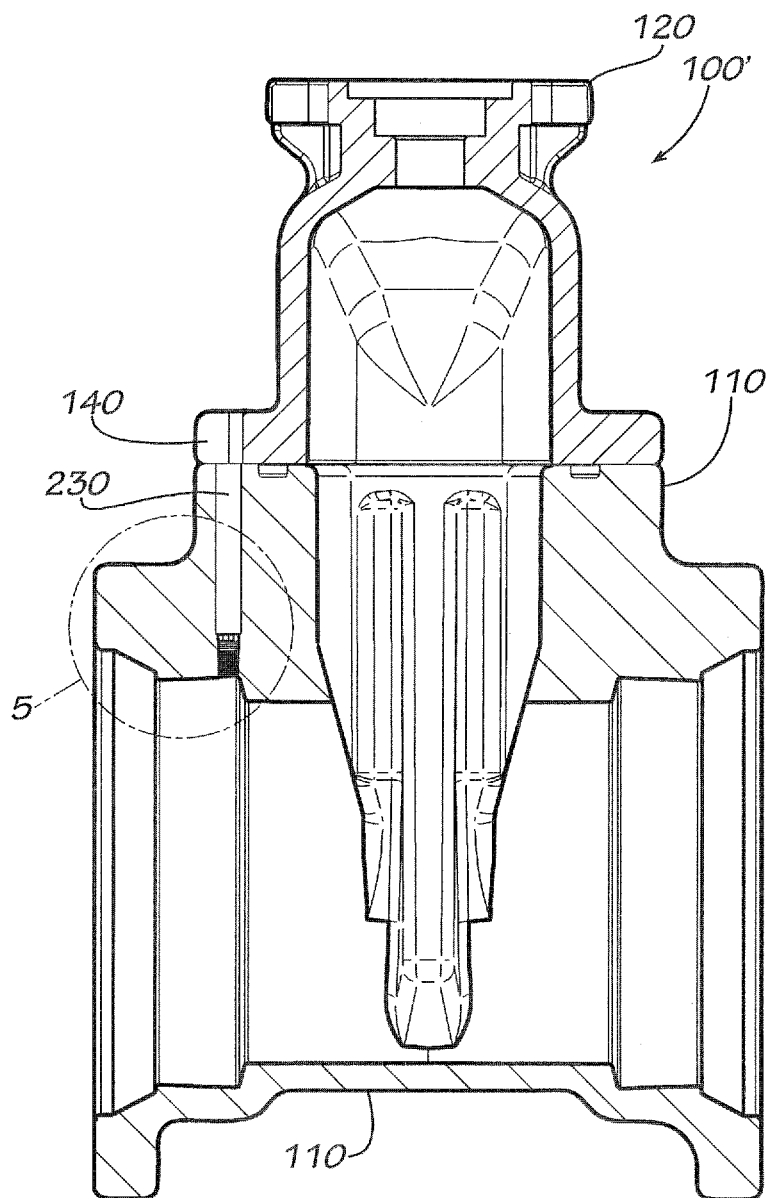


FIG. 4

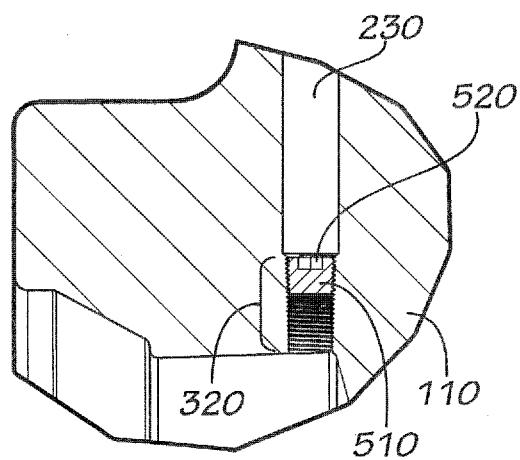


FIG. 5

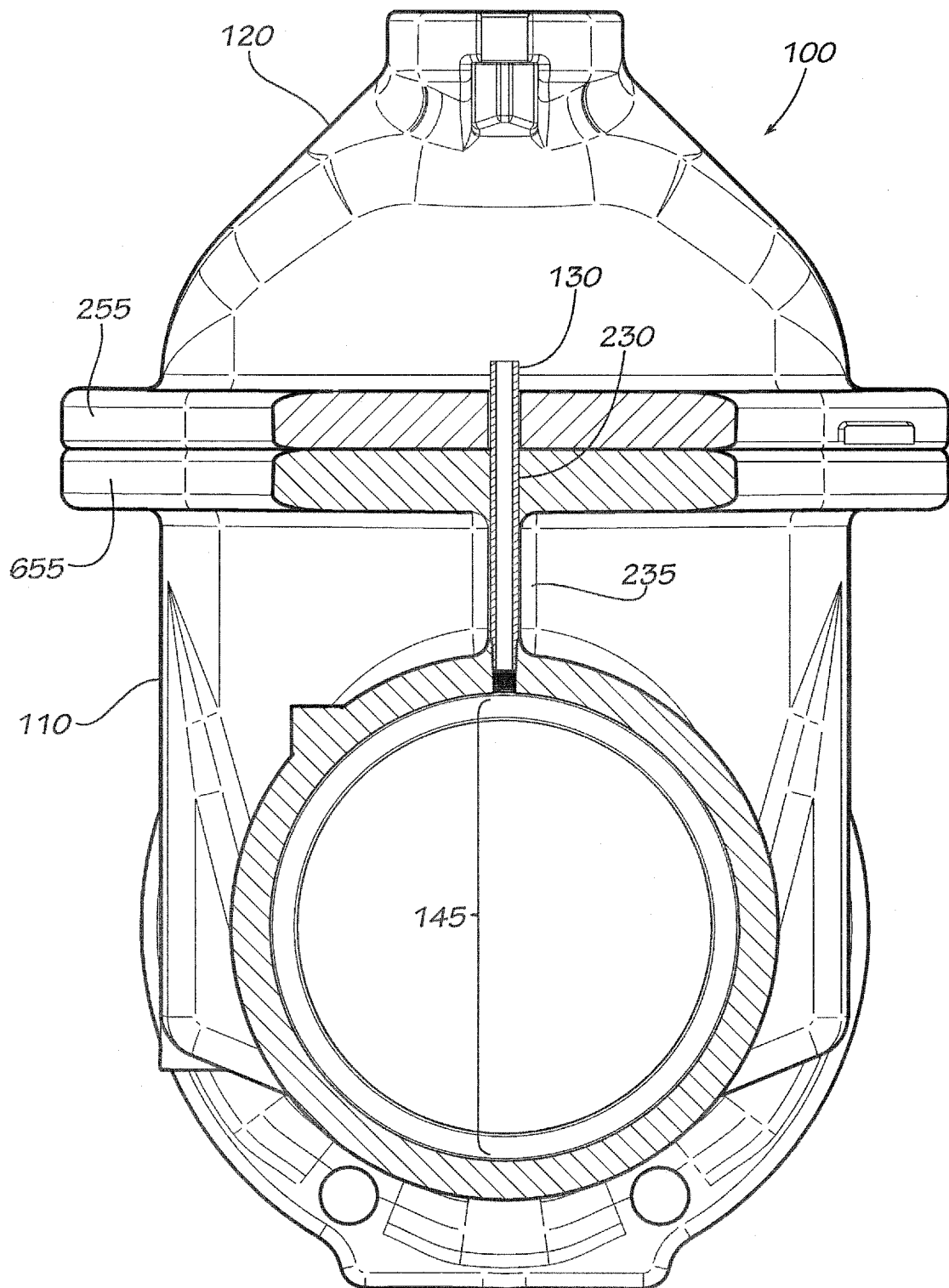


FIG. 6

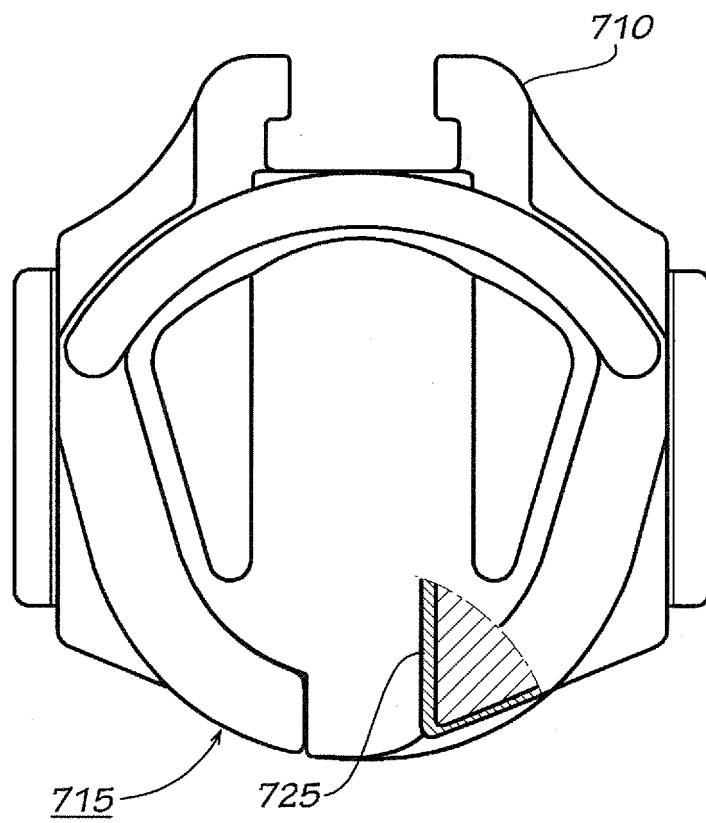


FIG. 7A

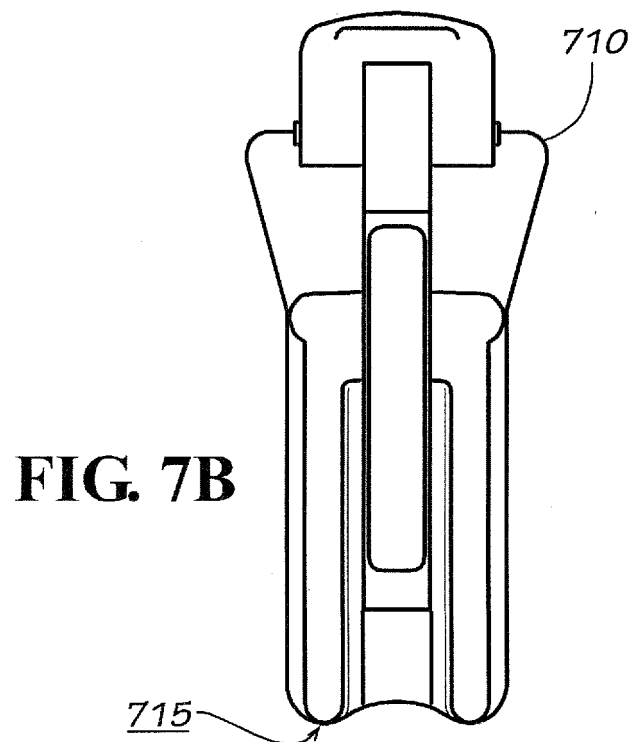


FIG. 7B

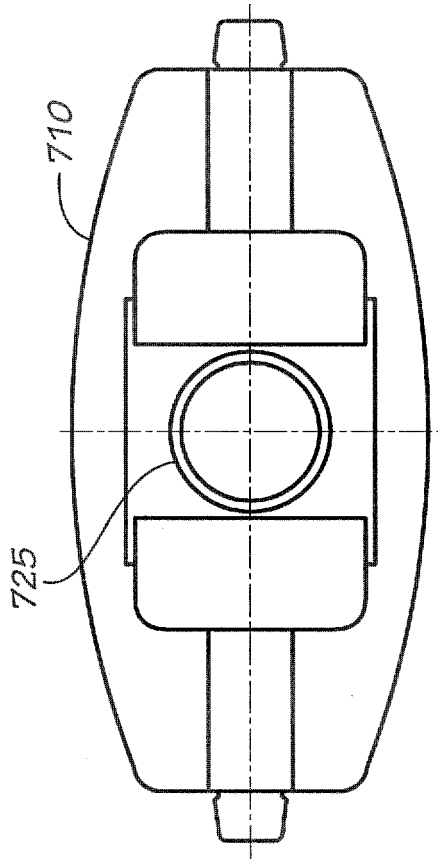


FIG. 7C

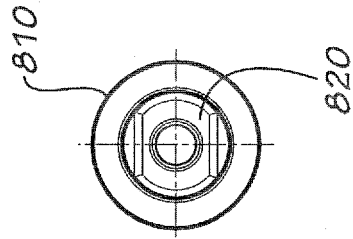


FIG. 8B

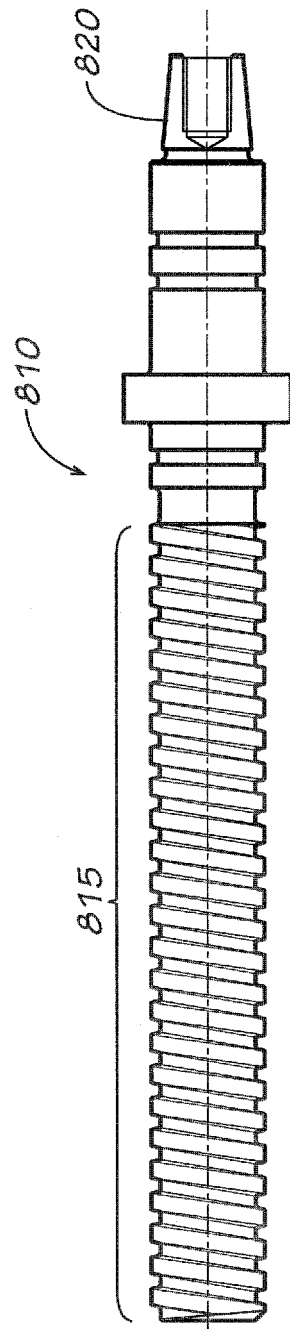


FIG. 8A

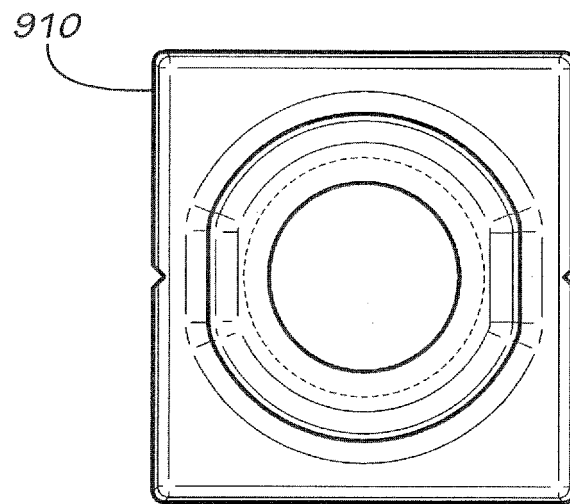


FIG. 9A

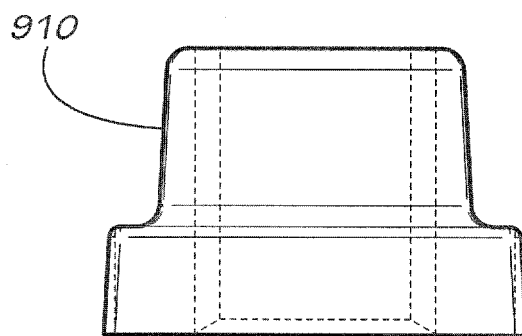


FIG. 9B

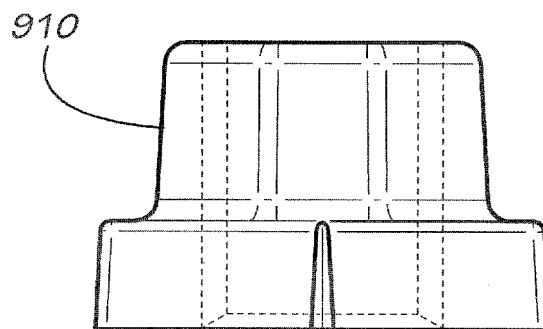


FIG. 9C

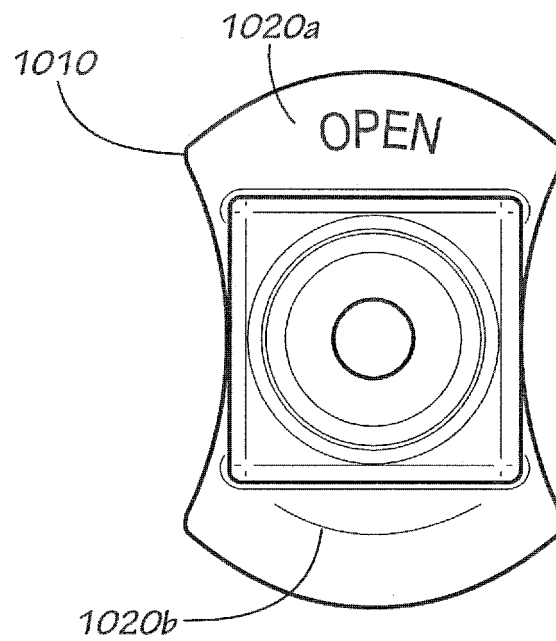


FIG. 10A

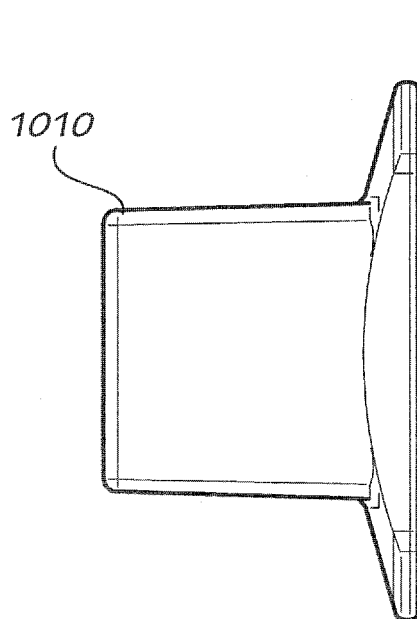


FIG. 10B

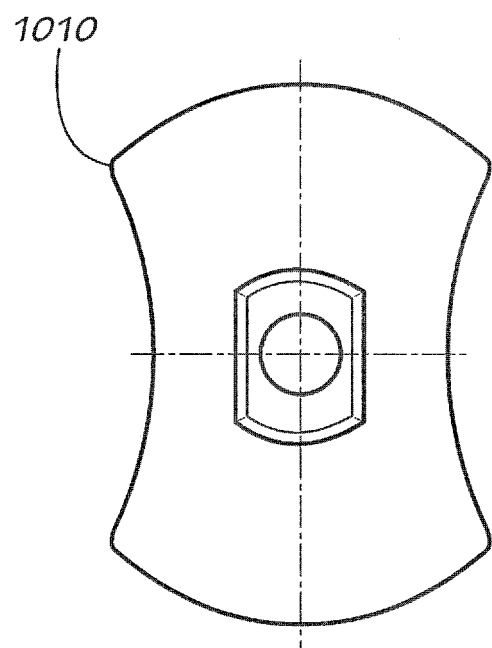


FIG. 10C

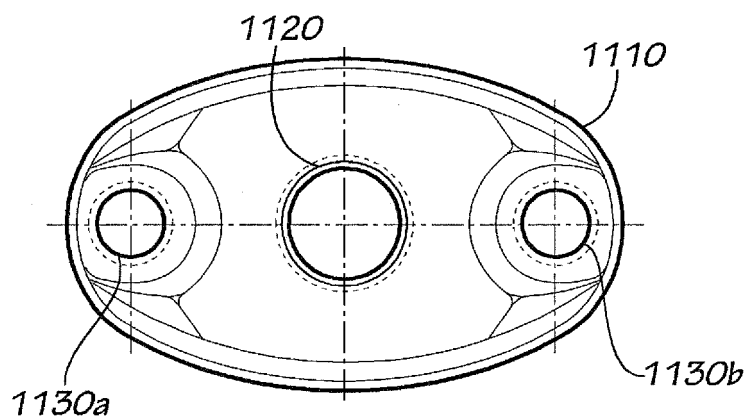


FIG. 11

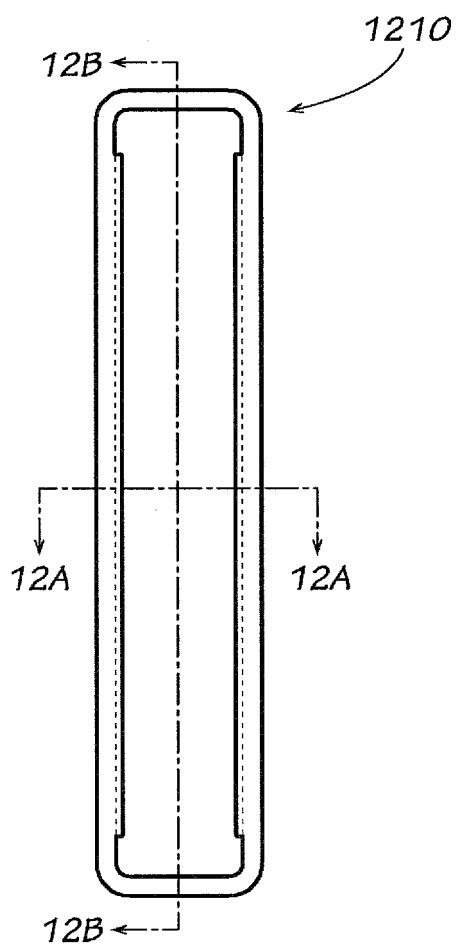


FIG. 12

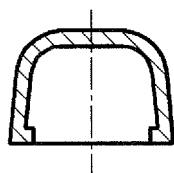


FIG. 12A

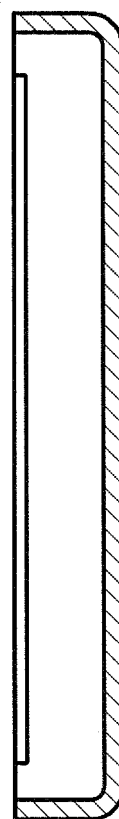


FIG. 12B

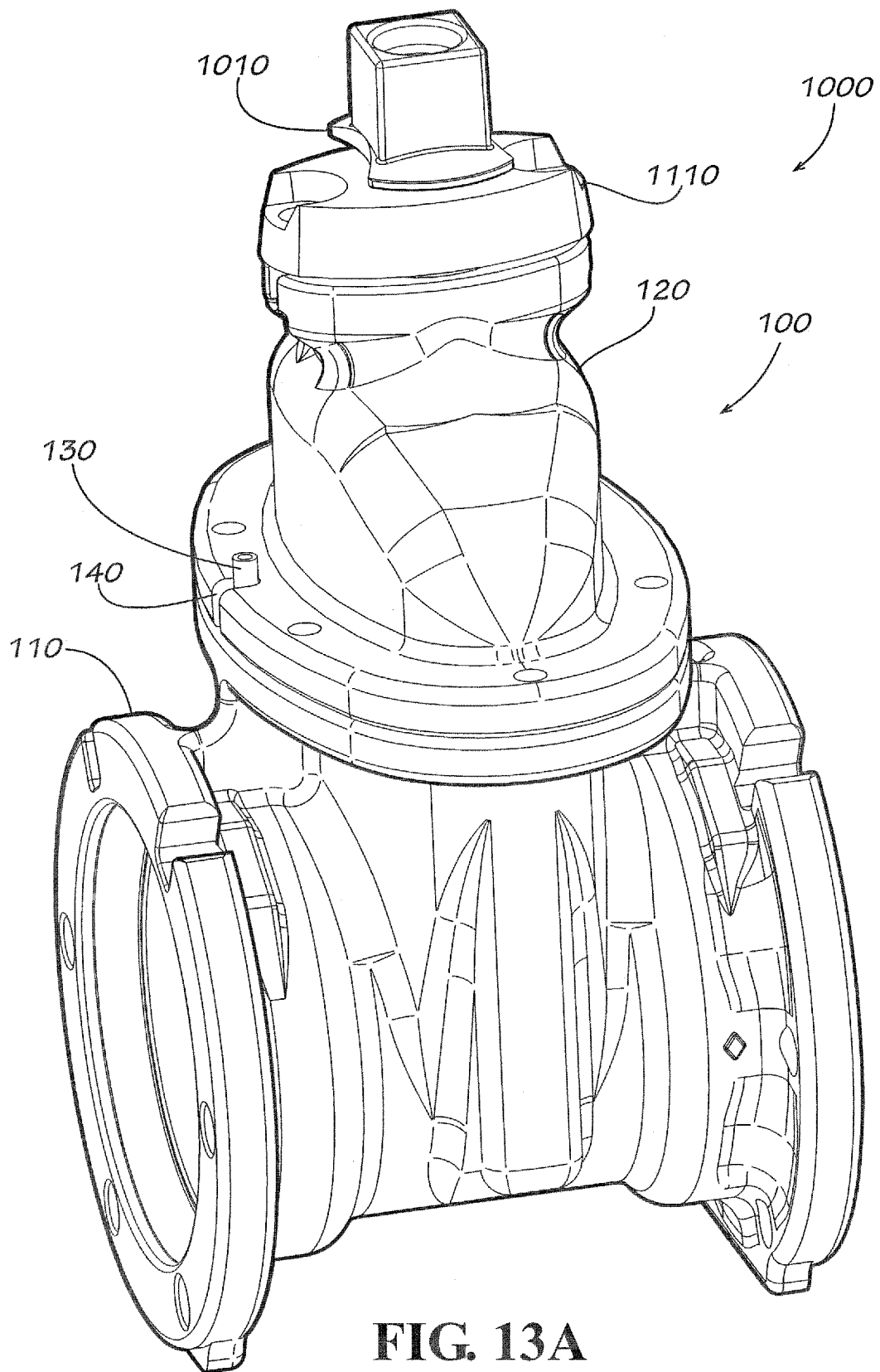


FIG. 13A

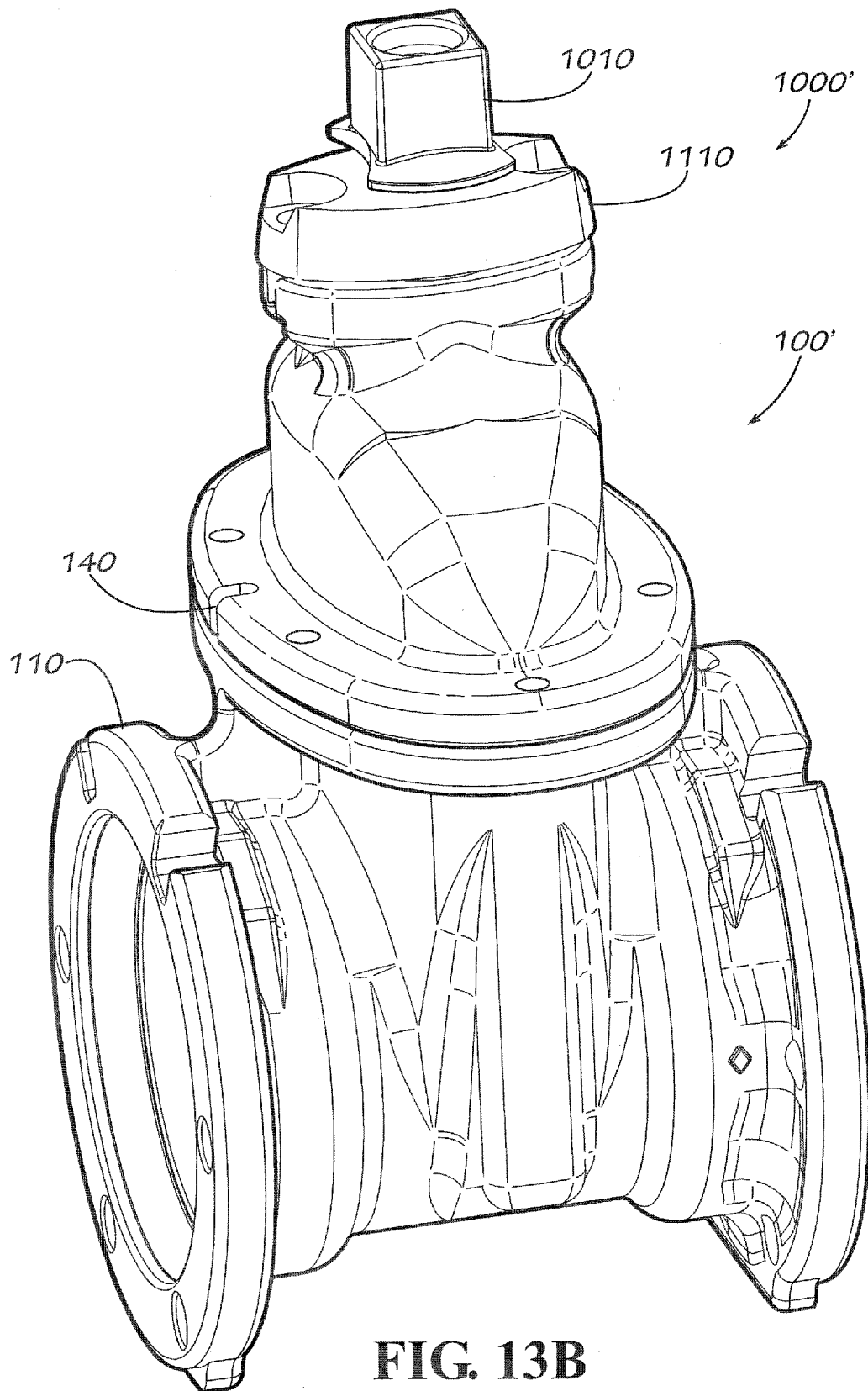


FIG. 13B

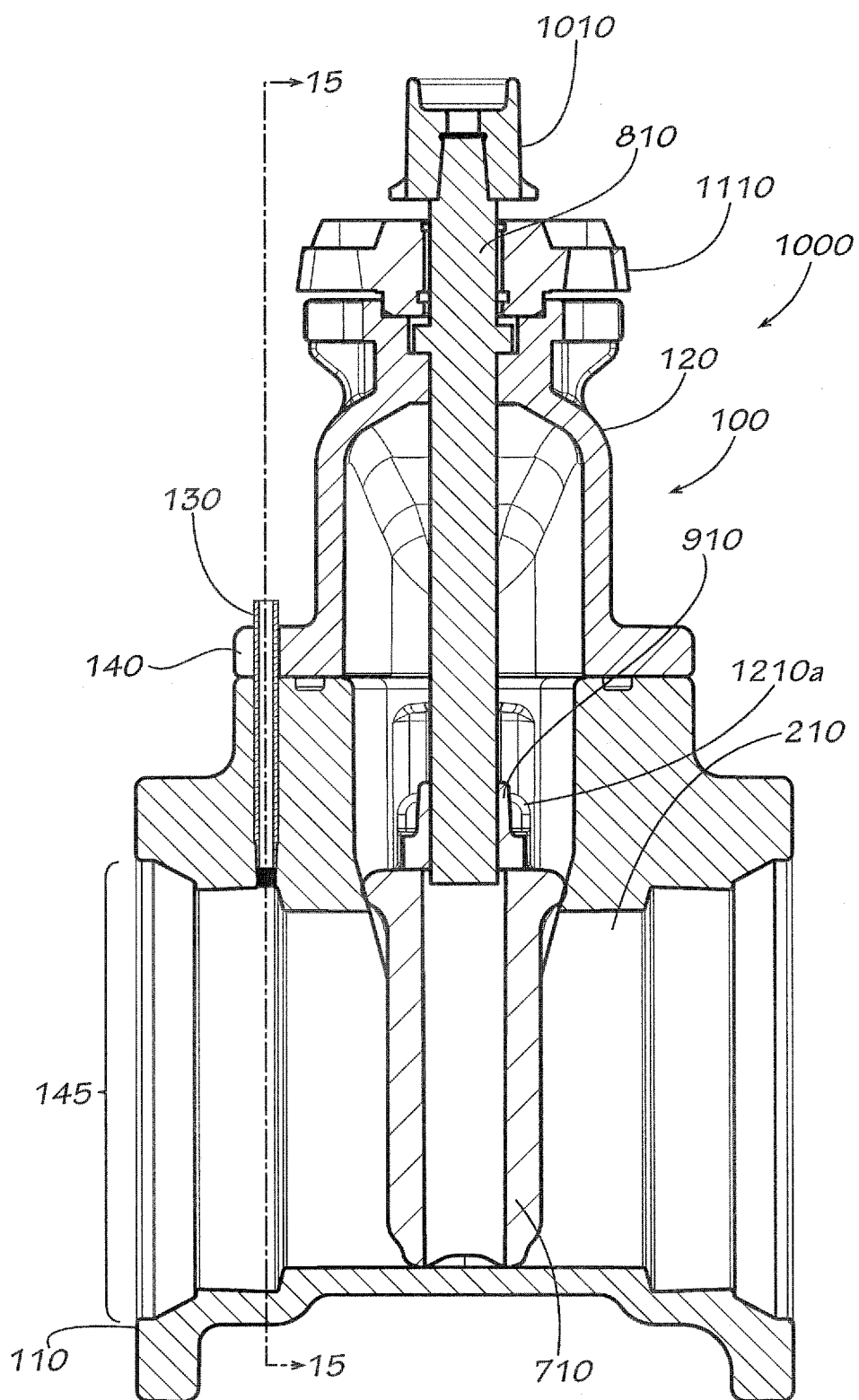


FIG. 14

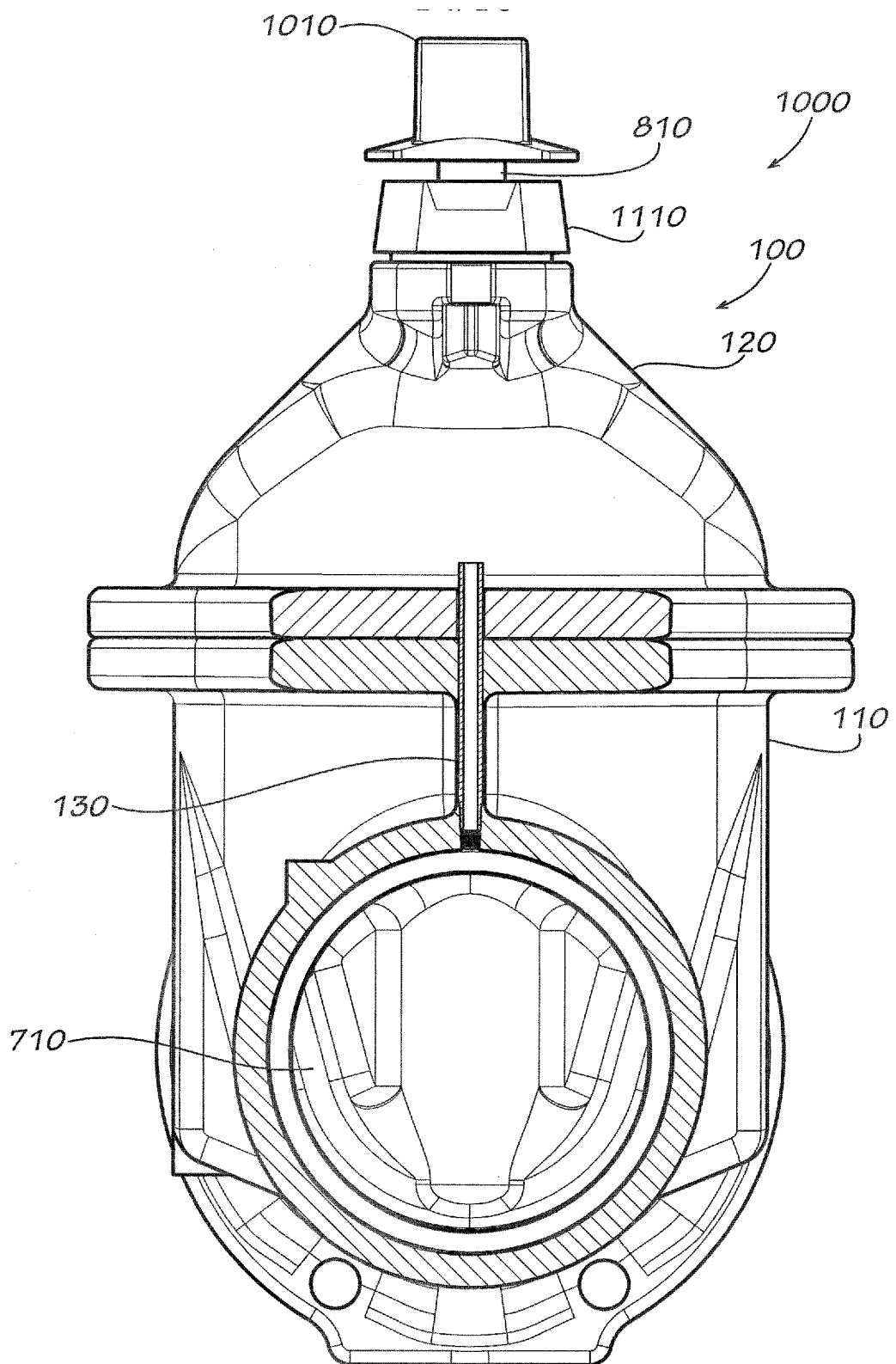


FIG. 15

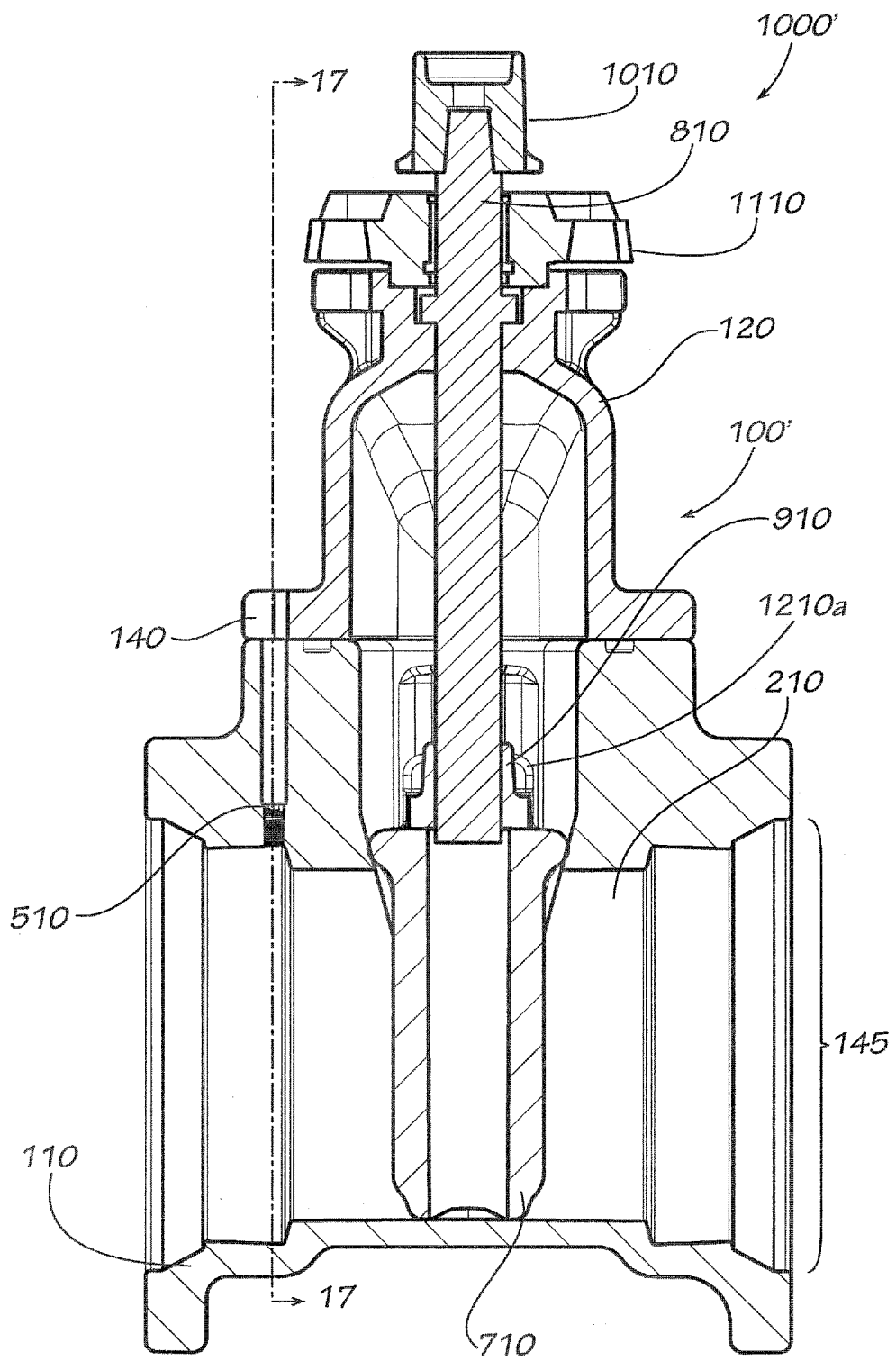


FIG. 16

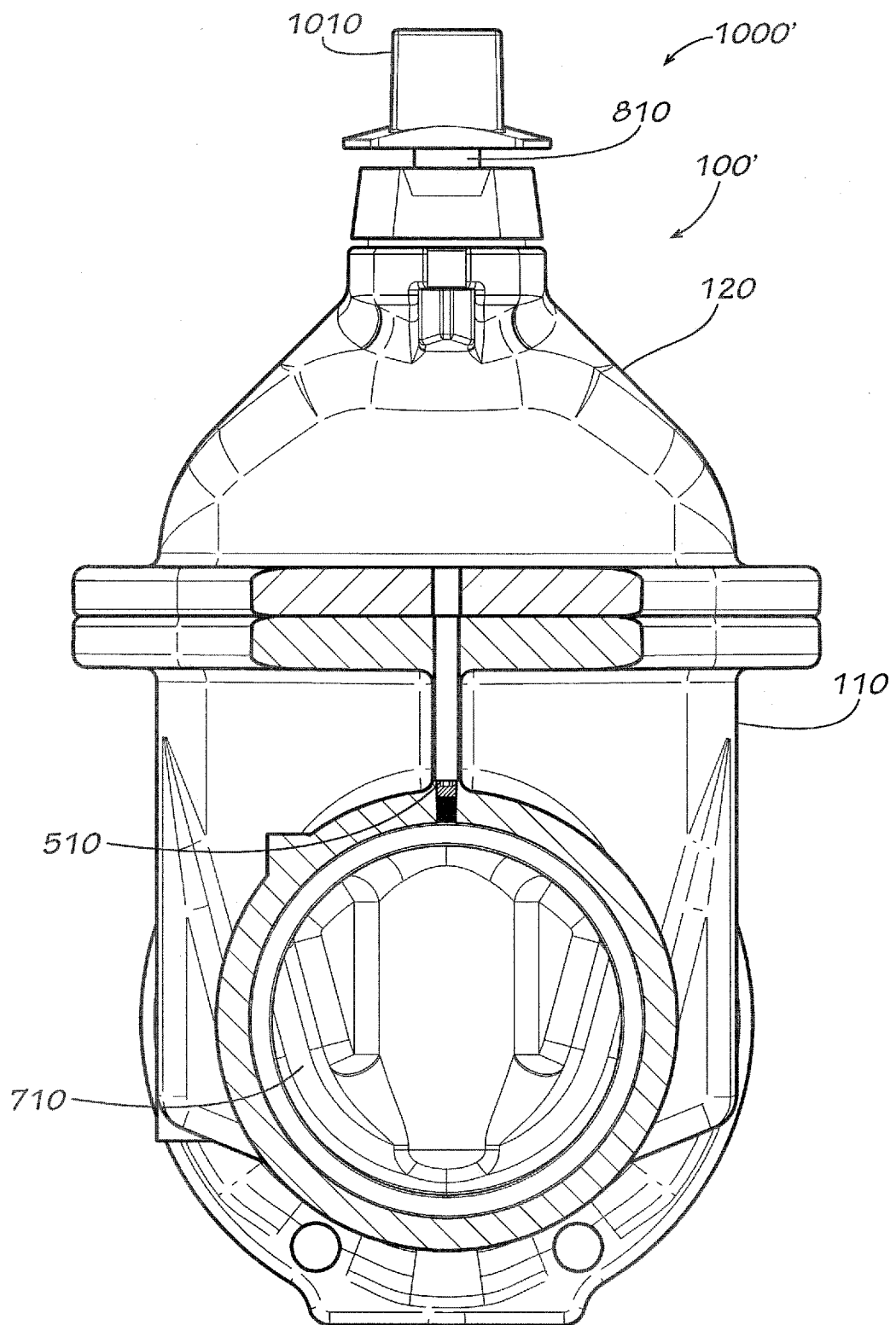


FIG. 17

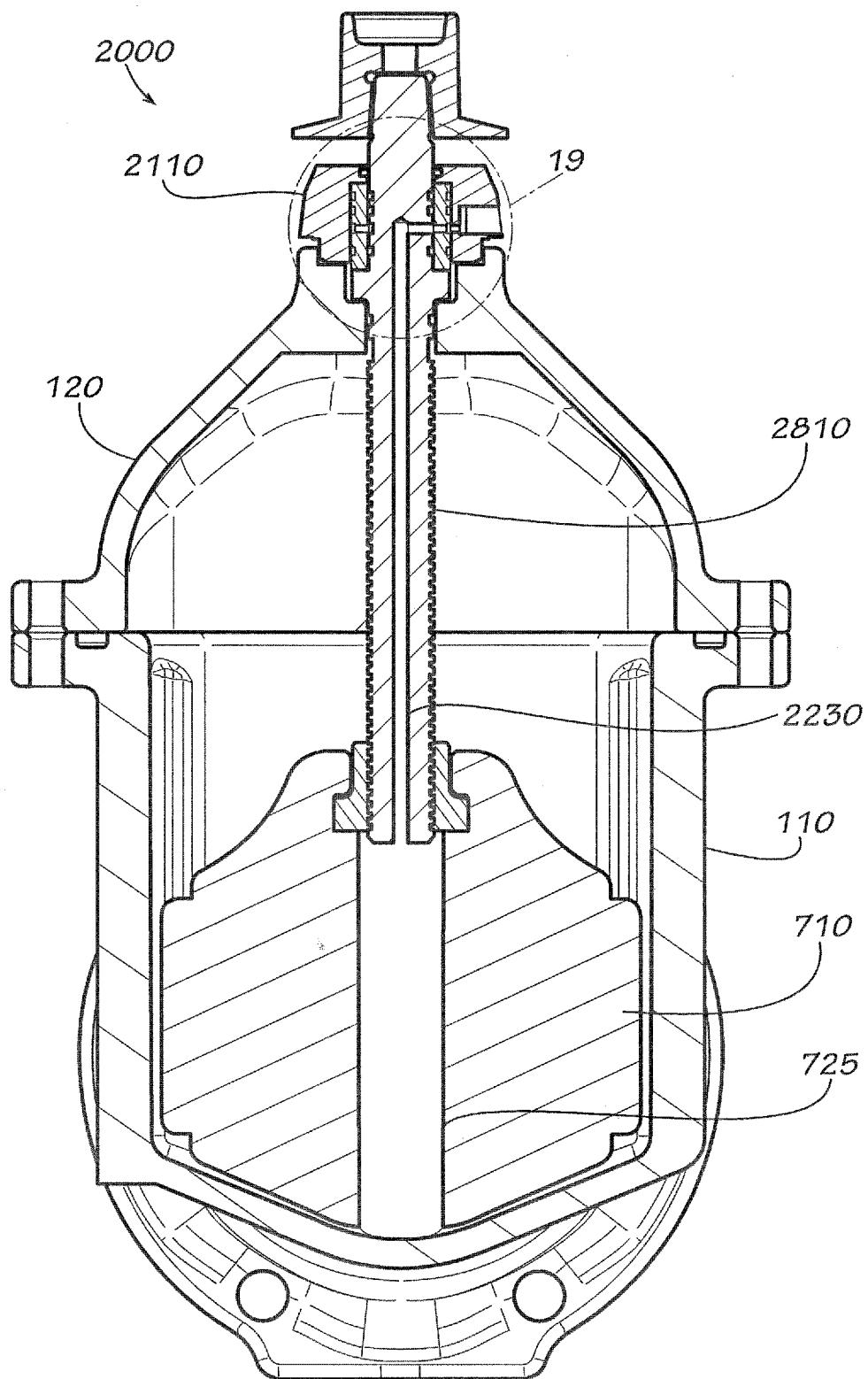


FIG. 18

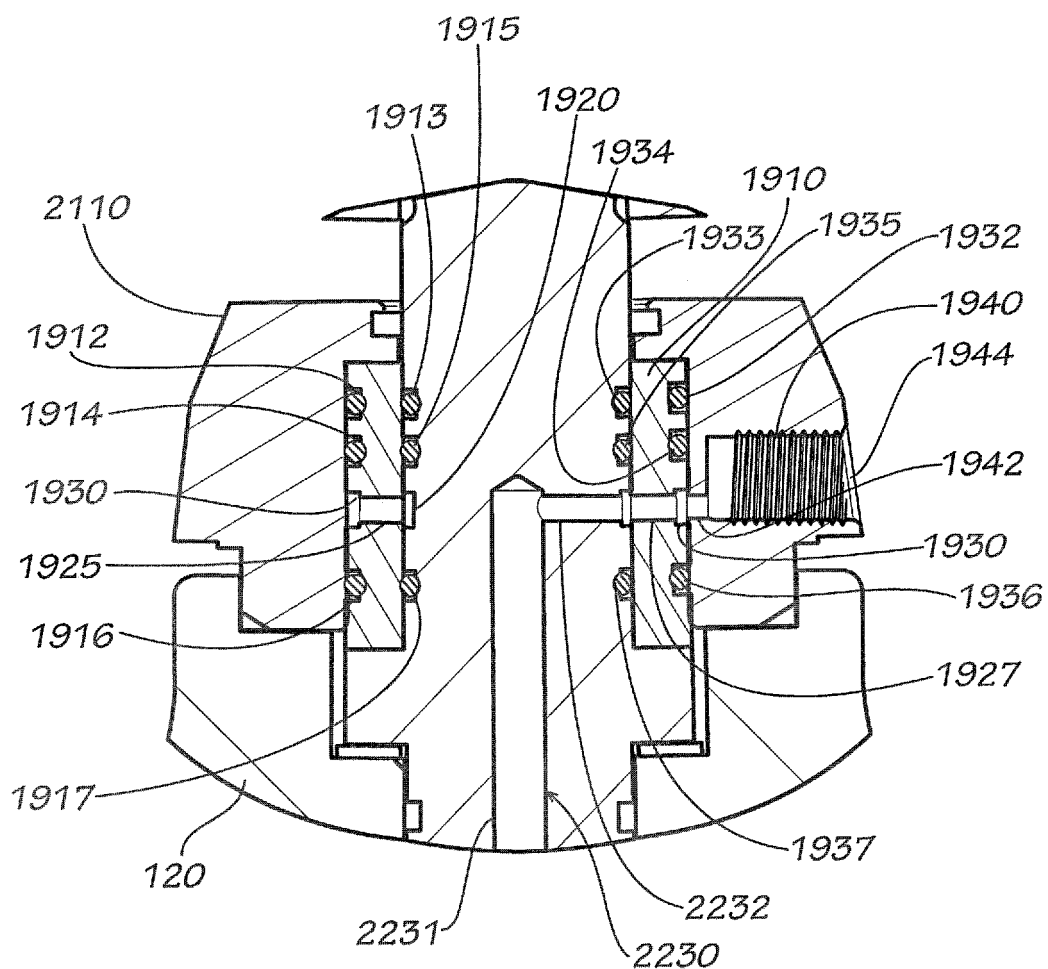


FIG. 19

REFERENCES CITED IN THE DESCRIPTION

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